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STAMMER2 PRODUCTION SYSTEM FOR TACTICAL SITUATION ASSESSMENT, V--ETC(U)
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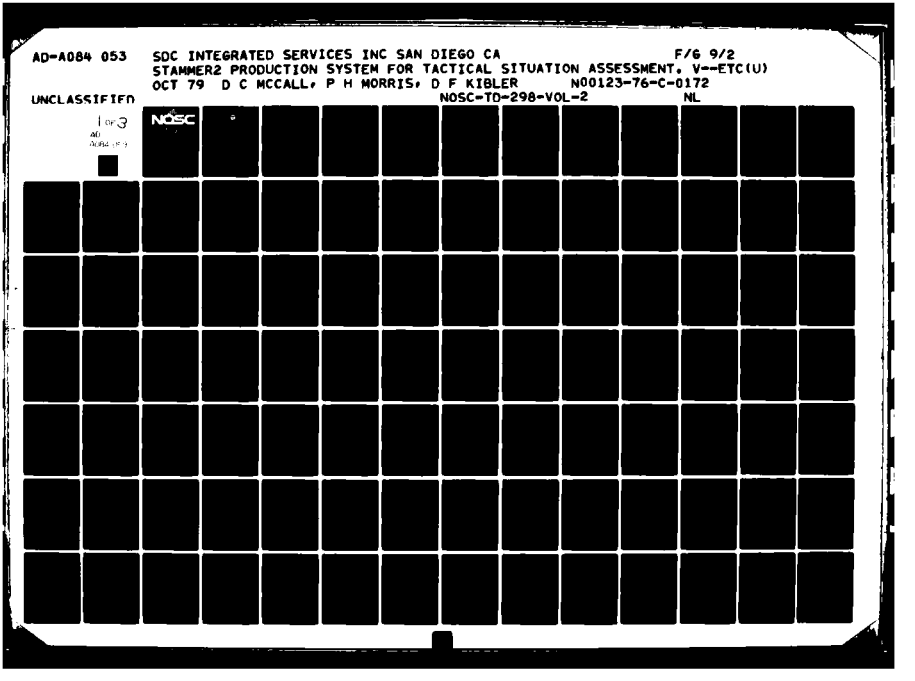

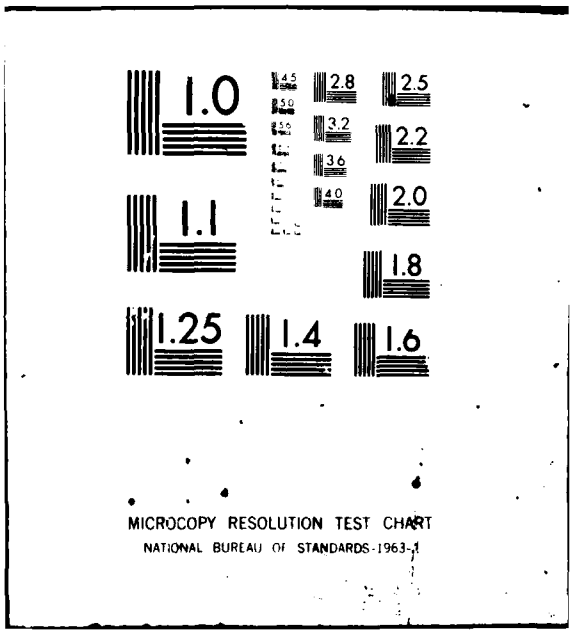
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Technical Document 298

STAMMER2 PRODUCTION SYSTEM FOR TACTICAL SITUATION ASSESSMENT

Volume 2 — Code
(Volume 1 consists of the design description)

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PH Morris, DF Kibler, RJ Bechtel
(SDC Integrated Services)
Contract N00123-76-C-0172

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Washington DC 20360

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AN ACTIVITY OF THE NAVAL MATERIAL COMMAND

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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)	
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19. KEY WORDS (Continue on reverse side if necessary and identify by block number) STAMMER2 Production systems Rule-based inference systems Confidence factors Tactical analyses Correlation techniques Merchant detection	
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) STAMMER2 is a revised version of STAMMER, a System for Tactical Assessment of Multisource Messages, Even Radar. STAMMER was created as part of an investigation of new correlation methodologies, and served as a testbed for explorations of applications of rule-based inference systems to the tactical situation assessment (TSA) problem. STAMMER concentrated on the specific task of merchant detection from radar and external messages. Experience with STAMMER revealed areas for improvement, which have led to the creation of STAMMER2. In addition to several changes in the underlying rule mechanisms used, the enhancements found in STAMMER2 arose out of a desire for greater generality and flexibility in the demonstration system, the explanation system, and the range of	

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20. (Continued)

acceptable inputs to the system. STAMMER2 should prove to be a more useful system for testing various rule/scenario collections. During the development that led to STAMMER2, further issues in the design of rule-based inference systems for use in support of C3 activities have become apparent and they are discussed. This volume consists of the code. Volume 1 consists of the design description.

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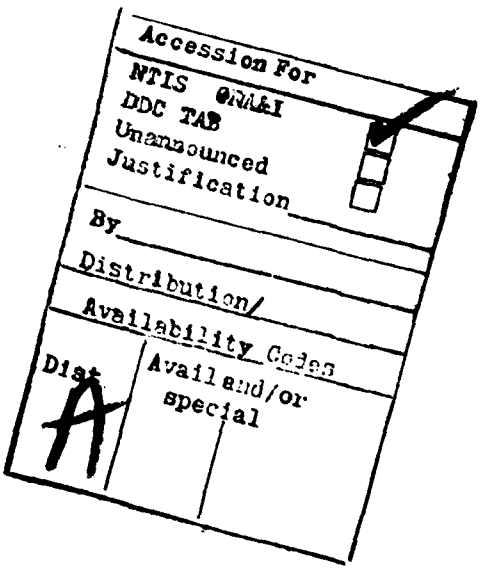

Organization of this Volume

Dealing with the code is always a problem. While it is, in a sense, the fruit of long labor, no one likes to list it out and include it in the prose report which is almost inevitably the final output of a programming effort. However, there are always questions which can be answered only by appeal to the code itself, making its availability a necessity, and its inclusion in a final report desirable.

We have dealt with the problem by making the code a separate volume of this final report. Those who need or want to see the messy details are welcome, while others can ignore them without qualms, and without the need to carry around listings that will never be used.

Code by itself, even when commented, can be particularly uninformative. We have attempted to make use of software engineering tools provided by INTERLISP to make wading through the program itself somewhat easier. After the listing, we include a tree which represents the calling sequence of the functions that make up STAMMER. It is important to not that not all of the functions in the code will be included in this tree, as some are intended to be top-level calls only, rather than called by other functions. However, this does give an idea of the flow through the functions during normal execution.

Following the calling sequence tree, we provide a brief description of each function, in alphabetical order. This

description includes calling and called-by information, along with variable binding information.

The insert before the code proper is a cross-reference from an alphabetical listing of function names to the name of the file in which they are included. This should make looking up code much easier, since the files are organized functionally, rather than lexically. This index also includes all properties and variables which are set in the file, though these are not given reference numbers.

Summary for files: <RBECHTAL>CONFIDENCE..23 24-Jul-79 13:44:49
<PMORRIS>DSPLA.LSP.88 10-Aug-79 16:19:32
<PMORRIS>FORK.LSP.19 18-Dec-78 16:30:43
<RBECHTAL>HASHER..38 7-Aug-79 19:03:11
<RBECHTAL>INTERP..37 28-Aug-79 21:06:16
<RBECHTAL>MANIPULATE..20 6-Aug-79 17:32:02
<RBECHTAL>MEMORY..17 6-Aug-79 19:06:57
<RBECHTAL>MSGMTR..27 23-Aug-79 17:56:55
<DKIBLER>NEWEXP.LSP.34 28-Aug-79 11:42:07
<DKIBLER>ORACLE.LSP.40 8-Aug-79 09:11:09
<DKIBLER>PLAT.LSP.48 6-Aug-79 11:01:49
<PMORRIS>QH.LSP.72 21-Aug-79 12:09:01
<RBECHTAL>RULES..29 27-Aug-79 21:39:39
<PMORRIS>STREAM.LSP.37 6-Aug-79 20:15:20
<RBECHTAL>TOPLEVEL..13 21-Aug-79 11:08:03

<ATTIS>		NEWEXP	ifprop:	QHPRODS
<EXPLTREE>		NEWEXP	ifprop:	QHPRODS
<ID2>		NEWEXP	ifprop:	QHPRODS
<IDAMP2>		NEWEXP	ifprop:	QHPRODS
<IDAMPIS>		NEWEXP	ifprop:	QHPRODS
<IDIS>		NEWEXP	ifprop:	QHPRODS
<OCCURNUM>		NEWEXP	ifprop:	QHPRODS
<OTHER2>		NEWEXP	ifprop:	QHPRODS
<PLATIS>		NEWEXP	ifprop:	QHPRODS
<TELLABT>		NEWEXP	ifprop:	QHPRODS
<TYPE2>		NEWEXP	ifprop:	QHPRODS
<TYPIS>		NEWEXP	ifprop:	QHPRODS
<VALIS>		NEWEXP	ifprop:	QHPRODS
<WHAT2FORM>		NEWEXP	ifprop:	QHPRODS
<WHATFORM>		NEWEXP	ifprop:	QHPRODS
<WHEREFORM>		NEWEXP	ifprop:	QHPRODS
<WHEREITEM>		NEWEXP	ifprop:	QHPRODS
<WHOSE2FORM>		NEWEXP	ifprop:	QHPRODS
<WHOSEFORM>		NEWEXP	ifprop:	QHPRODS
ADDH	88	HASHER	expr:	(ARGS NEWVAL)
ADDIS	257	TOPLEVEL	expr:	(SN)
AFTERSYSOUTFORMS		FORK	ADDVARS	
ALIAS		NEWEXP	ifprop:	PRINFORMS
ANDHACK	103	INTERP	expr:	(CONDITIONS ACTIONS EV)
APPLYRULE	104	INTERP	expr:	(RULENAME PREBIND)
ARRLOC	75	FORK	expr:	(ARR)
ASSERT	117	MANIPULATE	expr:	(ARGLIST NODENAME)
ASSERTION		NEWEXP	Set Variable	
ASSRPRINT	148	NEWEXP	expr:	(PRINSPEC)
AUXINTERPOL	222	PLAT	expr:	(PT1 PT2 DELTA)
BEARING		ORACLE	ifprop:	ORACLE
BEARING		ORACLE	ifprop:	ORTYPE
BEARING	181	ORACLE	expr:	(SITE)
BEEP	231	QH	expr:	NIL
BEYONDINTEREST	128	MSGMTR	expr:	(TXT)
BKDSPBUF	28	DSPLA	expr:	(X)
BLFN	5	CONFIDENCE	expr:	(BNODE)
BLOCKED-FROM		NEWEXP	ifprop:	PRINFORMS

BLOCKER		RULES	prop: CONDITIONS
BLOCKER		RULES	prop: ACTIONS
BLOCKER		RULES	prop: CONF
BMEAS	4	CONFIDENCE	expr: (BBOX)
BUMP	118	MANIPULATE	expr: (L)
CASSERT	119	MANIPULATE	expr: (SPEC VAL)
CENTROID	223	PLAT	expr: (VERTEXLIST)
CHANGECON	149	NEWEXP	expr: (RLNME1)
CKCONFIGURATION	258	TOPLEVEL	expr: NIL
CLASS		NEWEXP	ifprop: PRINFORMS
CLOSE-POPUP		RULES	prop: CONDITIONS
CLOSE-POPUP		RULES	prop: ACTIONS
CLOSE-POPUP		RULES	prop: CONF
CONFIDEBLOCK		CONFIDENCE	BLOCKS
CONSTRUCT	105	INTERP	expr: (ACTIONS EV COUNT)
CONTACT		NEWEXP	ifprop: PRINFORMS
COURSE		NEWEXP	ifprop: PRINFORMS
COURSE		ORACLE	ifprop: ORACLE
COURSE		ORACLE	ifprop: ORTYPE
COURSE	211	ORACLE	expr: (SITE)
COURSE-CHANGED		RULES	prop: CONDITIONS
COURSE-CHANGED		RULES	prop: ACTIONS
COURSE-CHANGED		RULES	prop: CONF
COURSEFROM		NEWEXP	ifprop: PRINFORMS
COURSEFROM		ORACLE	ifprop: ORACLE
COURSEFROM		ORACLE	ifprop: ORTYPE
COURSEFROM	213	ORACLE	expr: (POS1 POS2)
CREATECONTACT		RULES	prop: CONDITIONS
CREATECONTACT		RULES	prop: ACTIONS
CREATECONTACT		RULES	prop: CONF
CREATEDETECT		RULES	prop: CONDITIONS
CREATEDETECT		RULES	prop: ACTIONS
CREATEDETECT		RULES	prop: CONF
CREATEPLAT		RULES	prop: CONDITIONS
CREATEPLAT		RULES	prop: ACTIONS
CREATEPLAT		RULES	prop: CONF
CREATH	89	HASHER	expr: (SIZE)
CROSSBOUNDARY	188	ORACLE	expr: (PT1 PT2 POLY)
CROSSLINES	191	ORACLE	expr: (A B P Q)
CROSSPATHS		NEWEXP	ifprop: PRINFORMS
CROSSPATHS		ORACLE	ifprop: ORACLE
CROSSPATHS		ORACLE	ifprop: ORTYPE
CROSSPATHS	197	ORACLE	expr: (S1 S2 T1 T2)
CRUNCH	18	DSPLA	expr: (X)
CURTIME		MSGMTR	Saved Variable
DECSAMEDIGITS	29	DSPLA	expr: (X)
DEFINEPD	236	RULES	expr: NIL
DENY	120	MANIPULATE	fexpr*: L
DESCRIBEMSG	129	MSGMTR	expr: (TXT)
DETECTION		NEWEXP	ifprop: PRINFORMS
DIRECTION	209	ORACLE	expr: (LAT1 LON1 LAT2 LON2)
DISPCHECK	130	MSGMTR	expr: (NAME)
DISPLAY	131	MSGMTR	expr: (PLATNAME LAT LON TIME)
DISPLOB	132	MSGMTR	expr: (PNAME SPOS DPOS TIME)
DISPMARK	133	MSGMTR	expr: (NAME)
DISSIMILAR		NEWEXP	ifprop: PRINFORMS
DISSIMILPLAT	200	ORACLE	expr: (PLAT1 PLAT2)

```
DISTANCE          184 ORACLE       expr: (LAT1 LON1 LAT2 LON2)
DISTANT-POPUP         RULES      prop: CONDITIONS
DISTANT-POPUP         RULES      prop: ACTIONS
DISTANT-POPUP         RULES      prop: CONF
DISTOLINE         185 ORACLE       expr: (X Y X1 Y1 X2 Y2)
DLFN                8 CONFIDENCE   expr: (DNODE)
DMEAS               7 CONFIDENCE   expr: (DBOX)
DSPADDINC          23 DSPLA        expr: (NAME LAT LON TIME)
DSPADDINCS         41 DSPLA        expr: (NAME INCLST)
DSPADDTRH          22 DSPLA        expr: (NAME ID TYPE)
DSPCHGTRH          42 DSPLA        expr: (NAME ID TYPE)
DSPCMD             14 DSPLA        expr: (CMD WAITFLG)
DSPCNVRT           19 DSPLA        expr: (X)
DSPERASE           35 DSPLA        expr: NIL
DSPEXCH            36 DSPLA        expr: (NAME)
DSPEXCHBUF            DSPLA      Set Variable
DSPEXCHEMP            DSPLA      Set Variable
DSPEXP            172 NEWEXP       expr: (BOX)
DSPGRAB            24 DSPLA        expr: (TTYNO)
DSPINIT            15 DSPLA        expr: NIL
DSPLAYFLG             MSGMTR     Saved Variable
DSPMAP             37 DSPLA        expr: NIL
DSPNOMAP           38 DSPLA        expr: NIL
DSPNOWAITFLG          FORK       Set Variable
DSPNUMAT           20 DSPLA        expr: (X)
DSPQUIET           27 DSPLA        expr: NIL
DSPRELD            25 DSPLA        expr: NIL
DSPSAVE            43 DSPLA        expr: NIL
DSPSTAT            40 DSPLA        expr: NIL
DSPTOP             39 DSPLA        expr: (WAITFLG)
DSPTTY             26 DSPLA        expr: NIL
DSPTTYSTR          31 DSPLA        expr: NIL
DUALFLG               TOPLEVEL   Saved Variable
DULLREL               NEWEXP     Set Variable
EMITTER               NEWEXP     ifprop: PRINFORMS
ENDSTREAM         240 STREAM       expr: (S)
ESTIMATE          216 PLAT         expr: (SITE1 SITE2 GAP)
EWMSG             134 MSGMTR       expr: (TXT EXTFLG)
EXLOOP            259 TOPLEVEL     expr: NIL
EXPLAIN           150 NEWEXP       expr: NIL
EXPLAINFLAG           NEWEXP     Saved Variable
FANCYPROD         238 RULES        expr: (PRO)
FASTER-THAN-A-MERCHANT
                      RULES      prop: CONDITIONS
FASTER-THAN-A-MERCHANT
                      RULES      prop: ACTIONS
FASTER-THAN-A-MERCHANT
                      RULES      prop: CONF
FASTHAK            90 HASHER       expr: NIL
FIRST-SIGHTING        NEWEXP     ifprop: PRINFORMS
FIRST-VIEW            RULES      prop: CONDITIONS
FIRST-VIEW            RULES      prop: ACTIONS
FIRST-VIEW            RULES      prop: CONF
FIXLONG           225 PLAT         expr: (X)
FKACS              54 FORK         expr: NIL
FKACSRETURN        55 FORK         expr: (ARRAY)
FKARRADR           73 FORK         expr: (FKARRNAME FKINDEX FKNWORDS)
```

```
FKARRAY              62 FORK          fexpr: (FKA FKTYPE FKSIZE FKSIZE2)
FKARRAYBLOCK            FORK        BLOCKS
FKARRAYP             68 FORK          expr: (A)
FKARRAYSIZE          69 FORK          expr: (A)
FKARRAYTYPE          71 FORK          expr: (A)
FKBCHECK             72 FORK          expr: (N LO HI)
FKCALL               48 FORK          fexpr*: FKCX
FKCALLBLOCK             FORK        BLOCKS
FKCALLERR            58 FORK          expr: (FKCID)
FKCATYPE             49 FORK          expr: (FKID)
FKCORGET             63 FORK          expr: (SIZE)
FKDDT                47 FORK          expr: (DDTFILE)
FKDDT                   FORK        prop: MACRO
FKDDT_                  FORK        prop: MACRO
FKELT                64 FORK          fexpr: (FKELT!A FKELT!N FKELT!WORDS)
FKELTI               65 FORK          fexpr: (FKELTI!A FKELTI!N
                                                 FKELTI!WORDS)
FKELTR               66 FORK          fexpr: (FKELTR!A FKELTR!N
                                                 FKELTR!WORDS)
FKFLOAT              74 FORK          expr: (ADR)
FKHALT                  FORK        prop: MACRO
FKHNDL                  FORK        prop: MACRO
FKHT                    FORK        prop: MACRO
FKHT_                   FORK        prop: MACRO
FKIDPB                  FORK        prop: MACRO
FKINIT               44 FORK          fexpr: (PROGRAM)
FKJFN                   FORK        prop: MACRO
FKJSYS               85 FORK          expr: (FKJSYSNO ARG1 ARG2 ARG3 ARG4
                                                 ARG5)
FKJSYSARG            86 FORK          expr: (X)
FKJSYSBLOCK             FORK        BLOCKS
FKKILL               45 FORK          expr: NIL
FKPROG                  FORK        prop: MACRO
FKRACS                  FORK        prop: MACRO
FKRTN                56 FORK          expr: (TYPE A N)
FKSACS                  FORK        prop: MACRO
FKSAVE               46 FORK          expr: (FILE)
FKSETA               67 FORK          fexpr: (FKARRY FKINDEX FKEXPR)
FKSETVAL             79 FORK          fexpr: (FKADR FKBIAS FKVAL)
FKSHR                   FORK        prop: MACRO
FKSR                 50 FORK          expr: (A I STR)
FKSW                 59 FORK          expr: (FKHNDL I FKNOWAITFLG)
FKSYM                80 FORK          expr: (ID FKHT NOBREAK)
FKSYMACS                FORK        prop: MACRO
FKSYMBLOCK              FORK        BLOCKS
FKSYMP               82 FORK          expr: (ID)
FKSYMPUT             81 FORK          expr: (FKHT ID V)
FKTIME               84 FORK          expr: (FKEXPR)
FKTTYSET             61 FORK          expr: (BOOL)
FKVAL                76 FORK          fexpr: (FKADR FKBIAS FKWORDS)
FKVALAT              21 DSPLA         fexpr: (ID BIAS NVALS)
FKVALI               78 FORK          fexpr: (FKADR FKBIAS FKWORDS FKREAL)
FKVALR               77 FORK          fexpr: (FKADR FKBIAS FKWORDS)
FKWAIT               87 FORK          expr: (FKHNDL)
FKX                  60 FORK          fexpr: (FKCX)
FREEZE              241 STREAM        expr: NIL
FREEZEFLG               STREAM      Set Variable
```

```
FREEZELST              STREAM      Set Variable
FROM-PORT              NEWEXP      ifprop: PRINFORMS
GAMF            151    NEWEXP        expr: (WLK OVERRIDE)
GETATT          215    PLAT          expr: (REL NAME)
GETATTB         178    ORACLE        expr: (REL NODE)
GETCON            1    CONFIDENCE    expr: (SOMAST)
GETH             91    HASHER        expr: (ARGS)
GETMARK           2    CONFIDENCE    expr: (NODE)
GETMB             3    CONFIDENCE    expr: (BAST)
GETMD             6    CONFIDENCE    expr: (DAST)
GETMRVAL        250    STREAM        expr: (X COPYFLG)
GETPOINT        224    PLAT          expr: (POS BEAR RANGE)
GETPULSAR       106    INTERP        expr: (NODE)
GETRADIX50       83    FORK          expr: (S)
GETSH            92    HASHER        expr: (ARGS)
GETSTRIP         93    HASHER        expr: (ARGS)
GETUPLE         121    MANIPULATE    expr: (ASSER)
GLOBALVARS             FORK        ADDVARS
GRATEK           11    DSPLA         expr: NIL
GRAZE                  NEWEXP      ifprop: PRINFORMS
GRAZE                  ORACLE      ifprop: ORACLE
GRAZE                  ORACLE      ifprop: ORTYPE
GRAZE           206    ORACLE        expr: (S1 S2 T1 T2)
GREATER-THAN           NEWEXP      ifprop: PRINFORMS
GREATER-THAN           ORACLE      ifprop: ORACLE
GREATER-THAN           ORACLE      ifprop: ORTYPE
GREATER-THAN    179    ORACLE        expr: (Q1 Q2)
GREATESTPROB    135    MSGMTR        expr: (POSLIST)
HLPEXPLN        152    NEWEXP        expr: NIL
ID                     NEWEXP      ifprop: PRINFORMS
ID-AMPLIFY             NEWEXP      ifprop: PRINFORMS
ID-LANE                RULES       prop: CONDITIONS
ID-LANE                RULES       prop: ACTIONS
ID-LANE                RULES       prop: CONF
IDENT           136    MSGMTR        expr: (NAME)
IMPLIESASRT     153    NEWEXP        expr: (NODE)
IN-LANE                NEWEXP      ifprop: PRINFORMS
IN-LANE                ORACLE      ifprop: ORACLE
IN-LANE                ORACLE      ifprop: ORTYPE
IN-LANE         176    ORACLE        expr: (MLANE POS)
INCLUDEPLAT     260    TOPLEVEL      expr: (PNE)
INHERIT                RULES       prop: CONDITIONS
INHERIT                RULES       prop: ACTIONS
INHERIT                RULES       prop: CONF
INLANE          186    ORACLE        expr: (X Y LANE)
INSIDE                 NEWEXP      ifprop: PRINFORMS
INSIDE                 ORACLE      ifprop: ORACLE
INSIDE                 ORACLE      ifprop: ORTYPE
INSIDE          177    ORACLE        expr: (POS STORM)
INSIDE-A-MERCHANTLANE
                       NEWEXP      ifprop: PRINFORMS
INSIDE-A-STORM         RULES       prop: CONDITIONS
INSIDE-A-STORM         RULES       prop: ACTIONS
INSIDE-A-STORM         RULES       prop: CONF
INTERIOR        183    ORACLE        expr: (OLAT OLON POLYGON)
INTERPOLABLE    137    MSGMTR        expr: (TXT)
JUGGLE          154    NEWEXP        expr: (PAIR INSERTITEM)
```

```
JUSTBUILD        107 INTERP       expr: (SPEC EV NUMBER)
LAND-DIST            NEWEXP     ifprop: PRINFORMS
LANERANGE        195 ORACLE       expr: (ALAT ALON BLAT BLON CLAT CLON)
LESS-THAN            NEWEXP     ifprop: PRINFORMS
LESS-THAN            ORACLE     ifprop: ORACLE
LESS-THAN            ORACLE     ifprop: ORTYPE
LESS-THAN        180 ORACLE       expr: (Q1 Q2)
LINEREAD         239 RULES        expr: NIL
LINPOLY          187 ORACLE       expr: (PT1 PT2 POLY)
LOC-TIME         203 ORACLE       expr: (S)
LOCATION             NEWEXP     ifprop: PRINFORMS
LOCATION         198 ORACLE       expr: (S)
LOCH              94 HASHER       expr: (ARGS PUTFLG)
M                 12 DSPLA        fexpr*: L
MAKEPD           237 RULES        expr: (NAM CO AC TRUST)
MAKEPRINT        155 NEWEXP       expr: (RELN)
MAPH              95 HASHER       expr: (ARY ARYSZ ARYFN)
MAPRETALIST          STREAM     Set Variable
MAPRETDO         245 STREAM       expr: (SELT AI)
MAPRETRIEVE      244 STREAM       expr: (MAPRETX MAPRETINFO MAPRETFN)
MAPSTREAM        242 STREAM       expr: (MAPSTREAMX MAPSTREAMINFO
                                        MAPSTREAMFN)
MARKOFF            9 CONFIDENCE   expr: (NODE)
MARKON            10 CONFIDENCE   expr: (NODE MARK)
MASSAGE1         108 INTERP       expr: (SPECLIST)
MATCH-PLAT           RULES      prop: CONDITIONS
MATCH-PLAT           RULES      prop: ACTIONS
MATCH-PLAT           RULES      prop: CONF
MATCHER          122 MANIPULATE   expr: (L1 L2)
MAXSHIPSPEED         ORACLE     Saved Variable
MAYBE            123 MANIPULATE   fexpr*: L
MEDIUM           138 MSGMTR       expr: (NAME)
MEDIUM               NEWEXP     ifprop: PRINFORMS
MELD             139 MSGMTR       expr: (ID MED)
MEMDENSITY        96 HASHER       expr: NIL
MEMFACTOR            HASHER     Saved Variable
MEMLIMIT             HASHER     Saved Variable
MEMORY               HASHER     Saved Variable
MEMSAVE          156 NEWEXP       expr: (FEE)
MEMSIZE              HASHER     Saved Variable
MEMTEST           97 HASHER       expr: (X Y)
MERCHANTLANE         NEWEXP     ifprop: PRINFORMS
MIDP             140 MSGMTR       expr: (P1 P2)
MODE                 NEWEXP     ifprop: PRINFORMS
MODIFIER         157 NEWEXP       expr: NIL
MONTEK            13 DSPLA        expr: NIL
MSGFILE              MSGMTR     Saved Variable
MSGMTP           141 MSGMTR       expr: NIL
NEAREST          217 PLAT         expr: (PT LST)
NEWHASH           98 HASHER       expr: NIL
NEWSTREAM        243 STREAM       expr: NIL
NEWSYM           142 MSGMTR       expr: (NAME)
NEWVALOBJ        158 NEWEXP       expr: (ARRT)
NEXTH             99 HASHER       expr: (LOC ARG)
NICEANSWER       159 NEWEXP       expr: (ANS1)
NOFORK            57 FORK         expr: NIL
NOT-FIRST            NEWEXP     ifprop: PRINFORMS
```

```
NOT-FIRST-SIGHTING    RULES      prop: CONDITIONS
NOT-FIRST-SIGHTING    RULES      prop: ACTIONS
NOT-FIRST-SIGHTING    RULES      prop: CONF
NOT-KNOWN-COMBATANT   RULES      prop: CONDITIONS
NOT-KNOWN-COMBATANT   RULES      prop: ACTIONS
NOT-KNOWN-COMBATANT   RULES      prop: CONF
NOT-LAST              NEWEXP     ifprop: PRINFORMS
NOT-LAST-SIGHTING     RULES      prop: CONDITIONS
NOT-LAST-SIGHTING     RULES      prop: ACTIONS
NOT-LAST-SIGHTING     RULES      prop: CONF
NOTHACK          109  INTERP       expr: (CONDITIONS ACTIONS EV)
OCCURPRINT       160  NEWEXP       expr: (TIMES NODE)
OCTSAMEDIGITS     30  DSPLA        expr: (X)
ONEPOINT         218  PLAT         expr: (NODE GAP)
OPSIDES          192  ORACLE       expr: (A B P Q)
ORACLEHACK       110  INTERP       expr: (SPEC)
ORACLES               ORACLE     Saved Variable
ORBUILD          111  INTERP       expr: (SPEC EV)
ORHACK           112  INTERP       expr: (CONDITIONS ACTIONS EV)
OUTSIDE-ALL-LANES     RULES      prop: CONDITIONS
OUTSIDE-ALL-LANES     RULES      prop: ACTIONS
OUTSIDE-ALL-LANES     RULES      prop: CONF
OWNMSG           143  MSGMTR       expr: (TXT)
OWNPOS           144  MSGMTR       expr: (TIME)
OWNSHIP               MSGMTR     Saved Variable
OWNSHIP               NEWEXP     ifprop: PRINFORMS
PARTING          261  TOPLEVEL     expr: NIL
PATROL                NEWEXP     ifprop: PRINFORMS
PLATFORM              NEWEXP     ifprop: PRINFORMS
PLATPOS          219  PLAT         expr: (PLAT TIME)
POSITION              NEWEXP     ifprop: PRINFORMS
POSS-REPORT      199  ORACLE       expr: (S1 S2 PATROL)
POSS-RPT              RULES      prop: CONDITIONS
POSS-RPT              RULES      prop: ACTIONS
POSS-RPT              RULES      prop: CONF
POSSIBLE-REPORT       NEWEXP     ifprop: PRINFORMS
PQ               226  QH           fexpr*: L
PREDECESSOR           ORACLE     ifprop: ORACLE
PREDECESSOR           ORACLE     ifprop: ORTYPE
PREDECESSOR      208  ORACLE       expr: (SITE)
PREDICTPOS       220  PLAT         expr: (NODELIST TIME)
PREHASH          100  HASHER       expr: (L)
PREPALIST        248  STREAM       expr: (CON ASS ALIST)
PRETTYANS        161  NEWEXP       expr: (ANSLST)
PRETTYASSR       162  NEWEXP       expr: (NODE FORMAT OVERCONF)
PRINCHAR          16  DSPLA        expr: (CODE)
PRINTRULEASSR    163  NEWEXP       expr: (RULEASSRTS)
PRODUCTIONS           RULES      Saved Variable
PULSAR           253  STREAM       expr: NIL
PULSE            254  STREAM       expr: (PULSAR)
PUTH             101  HASHER       expr: (ARGS AVAL)
PUTSH            102  HASHER       expr: (ARGS AVAL)
PUTSTREAM        255  STREAM       expr: (S X)
PUTTYP                FORK       prop: MACRO
QHASK            230  QH           expr: (INBUF)
QHCLEAR          227  QH           expr: NIL
QHFOLLOW         233  QH           expr: (LL BUFPTR QHMATCH)
```

```
QHGET                    QH          MACROS
QHLIST              229  QH            expr: (PTR)
QHMAKE              228  QH            expr: (QHMAKEX QHMAKEY SHOWFLG)
QHPREP              234  QH            expr: (FOCUS QHLST SHOWFLG STK)
QHPUT                    QH          MACROS
QHSHOW              235  QH            expr: (L)
QHTAKE              232  QH            fexpr*: L
RADAR-MODE               NEWEXP      ifprop: PRINFORMS
RANGE                    NEWEXP      ifprop: PRINFORMS
RANGE                    ORACLE      ifprop: ORACLE
RANGE                    ORACLE      ifprop: ORTYPE
RANGE               210  ORACLE        expr: (SITE)
REACHABLE                RULES       prop: CONDITIONS
REACHABLE                RULES       prop: ACTIONS
REACHABLE                RULES       prop: CONF
REACHABLE-BY-A-COMBATANT
                         NEWEXP      ifprop: PRINFORMS
RECAPCONCS          164  NEWEXP        expr: NIL
RELATIONS                NEWEXP      Saved Variable
RESOUT              165  NEWEXP        expr: NIL
RESULTLIST               TOPLEVEL    Saved Variable
RESULTPRINTER       166  NEWEXP        expr: (RES1)
RETPULSEDO          246  STREAM        expr: (SELTAI)
RETRIEVER           124  MANIPULATE    expr: (SPEC)
RETRIEVES           247  STREAM        expr: (AT OBJ VAL SEL)
RETSTREAM           249  STREAM        expr: (C)
RETVARS             125  MANIPULATE    expr: (SPEC)
ROTSENSE            193  ORACLE        expr: (A B C)
ROUGHLY-THE-SAME-COURSE-AS
                         NEWEXP      ifprop: PRINFORMS
ROUGHLY-THE-SAME-COURSE-AS
                         ORACLE      ifprop: ORACLE
ROUGHLY-THE-SAME-COURSE-AS
                         ORACLE      ifprop: ORTYPE
ROUGHLY-THE-SAME-COURSE-AS
                    175  ORACLE        expr: (Q1 Q2)
ROUGHLY-THE-SAME-SPEED-AS
                         NEWEXP      ifprop: PRINFORMS
ROUGHLY-THE-SAME-SPEED-AS
                         ORACLE      ifprop: ORACLE
ROUGHLY-THE-SAME-SPEED-AS
                         ORACLE      ifprop: ORTYPE
ROUGHLY-THE-SAME-SPEED-AS
                    174  ORACLE        expr: (Q1 Q2)
RULE                     NEWEXP      Set Variable
RULEXP              167  NEWEXP        expr: (RULE NODE)
SAILARG              52  FORK          expr: (FKARG FKHT)
SAILARRAYSIZE        70  FORK          expr: (A)
SAILCALL             51  FORK          fexpr*: FKCX
SAILSTRING           53  FORK          expr: (STRING)
SAME-AS                  NEWEXP      ifprop: PRINFORMS
SAME-AS                  ORACLE      ifprop: ORACLE
SAME-AS                  ORACLE      ifprop: ORTYPE
SAME-AS             173  ORACLE        expr: (W U)
SAVEPULSAR          113  INTERP        expr: (NODE)
SCRATCHFIVE              DSPLA       Set Variable
SCRATCHTEN               DSPLA       Set Variable
```

```
SENSORANGE              MSGMTR      Saved Variable
SENSORMSG          145  MSGMTR        expr: (TXT)
SERT               126  MANIPULATE    expr: (SPEC NODENAME)
SIGHTING                NEWEXP      ifprop: PRINFORMS
SIMPLY-REACHABLE        RULES       prop: CONDITIONS
SIMPLY-REACHABLE        RULES       prop: ACTIONS
SIMPLY-REACHABLE        RULES       prop: CONF
SIMPLY-WITHIN-REACH     NEWEXP      ifprop: PRINFORMS
SLOWER-THAN-A-MERCHANT
                        RULES       prop: CONDITIONS
SLOWER-THAN-A-MERCHANT
                        RULES       prop: ACTIONS
SLOWER-THAN-A-MERCHANT
                        RULES       prop: CONF
SMALL-CRAFT1            RULES       prop: CONDITIONS
SMALL-CRAFT1            RULES       prop: ACTIONS
SMALL-CRAFT1            RULES       prop: CONF
SMALL-CRAFT2            RULES       prop: CONDITIONS
SMALL-CRAFT2            RULES       prop: ACTIONS
SMALL-CRAFT2            RULES       prop: CONF
SMALL-CRAFT3            RULES       prop: CONDITIONS
SMALL-CRAFT3            RULES       prop: ACTIONS
SMALL-CRAFT3            RULES       prop: CONF
SMALL-CRAFT4            RULES       prop: CONDITIONS
SMALL-CRAFT4            RULES       prop: ACTIONS
SMALL-CRAFT4            RULES       prop: CONF
SMALL-CRAFT5            RULES       prop: CONDITIONS
SMALL-CRAFT5            RULES       prop: ACTIONS
SMALL-CRAFT5            RULES       prop: CONF
SMALL-CRAFT6            RULES       prop: CONDITIONS
SMALL-CRAFT6            RULES       prop: ACTIONS
SMALL-CRAFT6            RULES       prop: CONF
SMALL-CRAFT9            RULES       prop: CONDITIONS
SMALL-CRAFT9            RULES       prop: ACTIONS
SMALL-CRAFT9            RULES       prop: CONF
SMALLNUMB               NEWEXP      Set Variable
SOMELINESEG        189  ORACLE        expr: (SOMELINESEGX SOMELINESEGFN)
SOMEPULSE          251  STREAM        expr: (PULSAR PULSARDATA SOMEPULSEFN)
SOURCE                  NEWEXP      ifprop: PRINFORMS
SPAN               221  PLAT          expr: (L1 L2)
SPEED                   NEWEXP      ifprop: PRINFORMS
SPEED                   ORACLE      ifprop: ORACLE
SPEED                   ORACLE      ifprop: ORTYPE
SPEED              182  ORACLE        expr: (SITE)
SPEED-CHANGED           RULES       prop: CONDITIONS
SPEED-CHANGED           RULES       prop: ACTIONS
SPEED-CHANGED           RULES       prop: CONF
SPEEDAUX           212  ORACLE        expr: (T1 T2 DIST)
SPEEDFROM               NEWEXP      ifprop: PRINFORMS
SPEEDFROM               ORACLE      ifprop: ORACLE
SPEEDFROM               ORACLE      ifprop: ORTYPE
SPEEDFROM          214  ORACLE        expr: (POS1 T1 POS2 T2)
SPEEDM             205  ORACLE        expr: (T1 T2 DIST)
STAMMER            262  TOPLEVEL      expr: NIL
STARTUP            263  TOPLEVEL      expr: NIL
STATE              127  MANIPULATE    fexpr*: L
STATES                  NEWEXP      Saved Variable
```

```
STRENGTH              NEWEXP     ifprop: PRINFORMS
STRIPSTREAM       252 STREAM       expr: (S)
STUFFLN           264 TOPLEVEL     expr: (MLN)
SUBTEND           194 ORACLE       expr: (LAT1 LON1 LAT2 LON2)
SUCCESSOR             NEWEXP     ifprop: PRINFORMS
SUCCESSOR             ORACLE     ifprop: ORACLE
SUCCESSOR             ORACLE     ifprop: ORTYPE
SUCCESSOR         207 ORACLE       expr: (SITE)
SWEEPER           114 INTERP       expr: (CONDITIONS ACTIONS EV)
SWR                   NEWEXP     ifprop: PRINFORMS
SWR                   ORACLE     ifprop: ORACLE
SWR                   ORACLE     ifprop: ORTYPE
SWR               204 ORACLE       expr: (LT1 T1 LT2 T2)
TEKCOM             32 DSPLA        expr: (STR)
TEKTEST            33 DSPLA        expr: NIL
TEKWAIT            34 DSPLA        expr: NIL
TO-PORT               NEWEXP     ifprop: PRINFORMS
TOS                   NEWEXP     ifprop: PRINFORMS
TRACKINPOLY       190 ORACLE       expr: (TRACK POLY)
TWO-PLACE         146 MSGMTR       expr: (X)
TYPE                  NEWEXP     ifprop: PRINFORMS
UNCRUNCH           17 DSPLA        expr: (NUM)
UNFREEZE          256 STREAM       expr: NIL
UNLESSHACK        115 INTERP       expr: (CONDITIONS ACTIONS EV)
VAR?              116 INTERP       expr: (Q)
VDRELS                INTERP     Set Variable
WAITER            265 TOPLEVEL     expr: NIL
WEATHERMSG        147 MSGMTR       expr: (TXT)
WELCOME           266 TOPLEVEL     expr: NIL
WENT-AFTER            NEWEXP     ifprop: PRINFORMS
WENT-AFTER            ORACLE     ifprop: ORACLE
WENT-AFTER            ORACLE     ifprop: ORTYPE
WENT-AFTER        202 ORACLE       expr: (S1 T1 S2 T2 S3 T3 S4 T4)
WENT-BEFORE           NEWEXP     ifprop: PRINFORMS
WENT-BEFORE           ORACLE     ifprop: ORACLE
WENT-BEFORE           ORACLE     ifprop: ORTYPE
WENT-BEFORE       201 ORACLE       expr: (S1 T1 S2 T2 S3 T3 S4 T4)
WHAT2FORMFN       168 NEWEXP       expr: (PL)
WHATFORMFN        169 NEWEXP       expr: (REL OBJ)
WHOSE2FORMFN      170 NEWEXP       expr: (VAL REL)
WITHIN-REACH          NEWEXP     ifprop: PRINFORMS
WITHINR           196 ORACLE       fexpr*: L
YESNO             171 NEWEXP       expr: (ASSRSPEC)
carriagereturn        NEWEXP     Saved Variable
```

```
(FILECREATED "24-Jul-79 13:44:49" <RBECHTAL>CONFIDENCE..23 7975

     changes to:  BMEAS DMEAS

     previous date: "23-Jul-79 18:42:31" <RBECHTAL>CONFIDENCE..22)


(PRETTYCOMPRINT CONFIDENCECOMS)

(RPAQQ CONFIDENCECOMS ((FNS * CONFIDENCEFNS)
                       (BLOCKS * CONFIDENCEBLOCKS)))

(RPAQQ CONFIDENCEFNS (GETCON GETMARK GETMB BMEAS BLFN GETMD DMEAS DLFN
                             MARKOFF MARKON))
(DEFINEQ
                                                                    [1]

(GETCON
  [LAMBDA (SOMAST)                                  (* edited:
                                                    "19-Jul-79 12:49")

          (* GETCON computes the confidence in an assertion,
          which is defined as the measure of belief in the
          assertion less the measure of disbelief in the
          assertion. GETCON will also accept a list of
          assertions.)


    (COND
      ((NULL SOMAST)
        0.0)
      ((ATOM SOMAST)
        (FDIFFERENCE (GETMB SOMAST)
                     (GETMD SOMAST)))
      ((LISTP SOMAST)
        (MAPCAR SOMAST (FUNCTION GETCON])
                                                                    [2]

(GETMARK
  [LAMBDA (NODE)                                    (* edited:
                                                    "23-Jul-79 16:44")
    (GETPROP NODE (QUOTE SUPERMARK])
                                                                    [3]

(GETMB
  [LAMBDA (BAST)                                    (* edited:
                                                    "23-Jul-79 18:36")

          (* GETMB calculates the measure of belief in an
          assertion. If there is a derivation tree, the belief
          derived through it is preferred to the belief stored
          directly on the property list
          (if any). GETMB gets the list of derivation boxes
```

```
        and maps the function BMEAS overthem.
        When BMEAS is done, MBCOMB will hold the measure of
        belief (accumulated in accordance with the combining
        function developed for MYCIN))


    (PROG ((HNDL (GETPROP BAST (QUOTE DERIVE*)))
           (MBCOMB 0.0))
          (COND
            ((EQ (GETMARK BAST)
                 (QUOTE POS))
              (RETURN 0.0))
            ((EQ (GETMARK BAST)
                 (QUOTE NEG))
              (RETURN 1.0))
            (HNDL (MAPC HNDL (FUNCTION BMEAS))
                  (RETURN MBCOMB))
            (T (RETURN (GETPROP BAST (QUOTE MB])
```

[4]

```
(BMEAS
  [LAMBDA (BBOX)                                    (* edited:
                                                    "24-Jul-79 13:41")

        (* BMEAS operates on a single derivation box.
        If the box provides negative evidence it is ignored
        (it will be counted for the measure of disbelief).
        Otherwise the functions BLFN and DLFN are mapped
        over the assertion entries in the box.
        This results in BMEASANS being set to the minimum of
        the belief measures for each assertion in the box,
        while DMEASANS is set to the maximum of the
        disbelief measures. The difference between BMEASANS
        and DMEASANS, if positive, is multiplied by the rule
        confidence and combined with the measures produced
        by the other boxes. If the difference is negative,
        this box is ignored.)


    (PROG ((BASTLST (CDR BBOX))
           (RULECON (GETPROP (CAR BBOX)
                             (QUOTE CONF)))
           (BMEASANS 1.0)
           (DMEASANS 0.0))
          (COND
            ((MINUSP RULECON)
              (RETURN)))
          (RESETLST [RESETSAVE (MARKON BAST (QUOTE POS))
                               (QUOTE (AND (MARKOFF BAST]
                    (MAPC BASTLST (FUNCTION BLFN))
                    (MAPC BASTLST (FUNCTION DLFN)))
          (COND
            ((FGREATERP BMEASANS DMEASANS)
              (SETQ BMEASANS (FTIMES RULECON (FDIFFERENCE BMEASANS
                                                          DMEASANS)))
              (SETQ MBCOMB (FDIFFERENCE (FPLUS BMEASANS MBCOMB)
```

```
                                        (FTIMES BMEASANS MBCOMB])
```

[5]

```
(BLFN
  [LAMBDA (BNODE)                                    (* edited:
                                                     "23-Jul-79 18:38")

          (* BLFN looks at a single node contained in a
          derivation box. If the node is satisfying a negation
          condition, the measure of belief for use in
          confidence calculation is taken to be the measure of
          disbelief in the assertion. If the node is
          satisfying an unless condition, the measure of
          belief used is 1.0 if the confidence in the node is
          0.0 or less, otherwise the measure of belief is
          zero. For AND and OR conditions, BLFN just uses the
          measure of belief in the assertion.
          Having acquired a usable measure of belief, BLFN
          then tests this against BMEASANS
          (the minimal MB to this point), and sets BMEASANS to
          the minimum of these two.)


     (PROG ((BNCON 0.0))                             (* This sets up BNCON
                                                     with a floating number
                                                     box)
           [COND
             ((LISTP BNODE)
               (SELECTQ (CAR BNODE)
                        [NOT (SETQ BNCON (GETMD (CADR BNODE]
                        [UNLESS (PROGN (SETQ BNCON (GETCON (CADR BNODE)))
                                       (COND
                                         ((GREATERP BNCON 0.0)
                                           (SETQ BNCON 0.0))
                                         (T (SETQ BNCON 1.0]
                        (SETQ BNCON 0.0)))
             (T (SETQ BNCON (GETMB BNODE]
           (SETQ BMEASANS (MIN BNCON BMEASANS])
```

[6]

```
(GETMD
  [LAMBDA (DAST)                                     (* edited:
                                                     "23-Jul-79 18:39")

          (* GETMD corresponds to GETMB for measures of
          disbelief. It's used the same way, but calls its own
          subsidiary functions, DMEAS and DLFN.)


     (PROG ((DNDL (GETPROP DAST (QUOTE DERIVE*)))
            (MDCOMB 0.0))
           (COND
             ((EQ (GETMARK DAST)
                  (QUOTE POS))
               (RETURN 1.0))
```

```
            ((EQ (GETMARK DAST)                                    |
                 (QUOTE NEG))                                      |
              (RETURN 0.0))                                        |
            (DNDL (MAPC DNDL (FUNCTION DMEAS))                     |
                  (RETURN MDCOMB))                                 |
            (T (RETURN (GETPROP DAST (QUOTE MD])
```

[7]

```
(DMEAS
  [LAMBDA (DBOX)                                    (* edited:
                                                    "24-Jul-79 13:44")
                                                    (* See BMEAS for a
                                                    description. Substitute
                                                    DLFN for BLFN, etc.)
    (PROG ((DASTLST (CDR DBOX))
           (RULECON (GETPROP (CAR DBOX)
                             (QUOTE CONF)))
           (BMEASANS 1.0)
           (DMEASANS 0.0))
          (COND
            ((NOT (MINUSP RULECON))
              (RETURN)))
          (RESETLST [RESETSAVE (MARKON DAST (QUOTE NEG))           |
                               (QUOTE (AND (MARKOFF DAST]          |
                    (MAPC DASTLST (FUNCTION BLFN))                 |
                    (MAPC DASTLST (FUNCTION DLFN)))                |
          (COND
            ((FGREATERP BMEASANS DMEASANS)
              (SETQ DMEASANS (FTIMES RULECON (FDIFFERENCE DMEASANS
                                                          BMEASANS)))
                                                    (* Negative by negative
                                                    gives positive)
              (SETQ MDCOMB (FDIFFERENCE (FPLUS DMEASANS MDCOMB)
                                        (FTIMES DMEASANS MDCOMB])
```

[8]

```
(DLFN
  [LAMBDA (DNODE)                                   (* edited:
                                                    "23-Jul-79 18:41")
                                                    (* See BLFN for a
                                                    description of the
                                                    actions.)
    (PROG ((DNCON 0.0))
          [COND
            ((LISTP DNODE)
              (SELECTQ (CAR DNODE)
                       [NOT (SETQ DNCON (GETMB (CADR DNODE]          |
                       [UNLESS (PROGN (SETQ DNCON (GETCON (CADR DNODE)))
                                      (COND
                                        ((FGREATERP DNCON 0.0)
                                          (SETQ DNCON 1.0))        |
                                        (T (SETQ DNCON 0.0]        |
                       (SETQ DNCON 0.0)))                          |
            (T (SETQ DNCON (GETMD DNODE]                           |
          (SETQ DMEASANS (MAX DNCON DMEASANS])
```

[9]

```
(MARKOFF
  [LAMBDA (NODE)                                          (* edited:
                                                          "23-Jul-79 16:44")
    (REMPROP NODE (QUOTE SUPERMARK])
```

[10]

```
(MARKON
  [LAMBDA (NODE MARK)                                     (* edited:
                                                          "23-Jul-79 16:43")
    (PUTPROP NODE (QUOTE SUPERMARK)
            MARK])
)

(RPAQQ CONFIDENCEBLOCKS ((CONFIDEBLOCK GETCON GETMB BMEAS BLFN GETMD
                                       DMEAS DLFN
                                       (ENTRIES GETCON GETMB BMEAS BLFN
                                                GETMD DMEAS DLFN)
                                       (SPECVARS MBCOMB BAST BMEASANS
                                                 MDCOMB DAST DMEASANS)))
)
[DECLARE: DONTEVAL@LOAD DOEVAL@COMPILE DONTCOPY
(BLOCK: CONFIDEBLOCK GETCON GETMB BMEAS BLFN GETMD DMEAS DLFN
        (ENTRIES GETCON GETMB BMEAS BLFN GETMD DMEAS DLFN)
        (SPECVARS MBCOMB BAST BMEASANS MDCOMB DAST DMEASANS))
]
(DECLARE: DONTCOPY
  (FILEMAP (NIL (399 7481 (GETCON 411 . 923) (GETMARK 927 . 1060) (GETMB
1064 . 2079) (BMEAS 2083 . 3494) (BLFN 3498 . 4851) (GETMD 4855 . 5573)
(DMEAS 5577 . 6526) (DLFN 6530 . 7192) (MARKOFF 7196 . 7329) (MARKON
7333 . 7478)))))
STOP
```

```
(FILECREATED "10-Aug-79 16:19:32" <PMORRIS>DSPLA.LSP.88 10319


     changes to:  TEKTEST

     previous date: " 1-Aug-79 18:01:40" <PMORRIS>DSPLA.LSP.87)


 PRETTYCOMPRINT DSPLACOMS)

 RPAQQ DSPLACOMS [(FNS * DSPLAFNS)
        (DECLARE: DONTEVAL@LOAD DOEVAL@COMPILE DONTCOPY COMPILERVARS
                  (ADDVARS (NLAMA M)
                           (NLAML FKVALAT)
                           (LAMA)))
        (VARS (SCRATCHTEN (QUOTE (0 0 0 0 0 0 0 0 0 0)))
              (SCRATCHFIVE (QUOTE (0 0 0 0 0)))
              (DSPEXCHBUF (CONCAT
          "                                                    "
                                  (CHARACTER 0)))
              (DSPEXCHEMP (CONCAT
          "     E    M    P    T    Y                         "
                                  (CHARACTER 0])

(RPAQQ DSPLAFNS (GRATEK M MONTEK DSPCMD DSPINIT PRINCHAR UNCRUNCH
                        CRUNCH DSPCNVRT DSPNUMAT FKVALAT DSPADDTRH
                        DSPADDINC DSPGRAB DSPRELD DSPTTY DSPQUIET
                        BKDSPBUF DECSAMEDIGITS OCTSAMEDIGITS DSPTTYSTR
                        TEKCOM TEKTEST TEKWAIT DSPERASE DSPEXCH DSPMAP
                        DSPNOMAP DSPTOP DSPSTAT DSPADDINCS DSPCHGTRH
                        DSPSAVE))
(DEFINEQ

                                                                [11]

(GRATEK
  [LAMBDA NIL                                    (* edited:
                                                 " 1-Aug-79 17:48")
    (TEKCOM "WOR 33 H")
    (TEKCOM "GRA 3,33")
    (TEKCOM "SHR B")
    (PRINCHAR 29)
    (PRIN1 "BONE")
    (JSYS 60 31)
    (PRINCHAR 27)
    (PRINCHAR 12)
    (TERPRI)
    (DOBE])

                                                                [12]

(M
  [NLAMBDA L
    (NCONC DSPLAFNS L)
    (MAKEFILE (QUOTE DSPLA.LSP])
```

[13]

```
(MONTEK
  [LAMBDA NIL                                          (* edited:
                                                       "30-Jul-79 19:31")
    (TEKCOM "MON 34"])
```

[14]

```
(DSPCMD
  [LAMBDA (CMD WAITFLG)                                (* edited:
                                                       "30-Jul-79 16:03")
    (PROG (DSPNOWAITFLG)
          (FKCALL ERASE SUBR))
    (COND                                                                |
      (TEK4025 (GRATEK)))                                                |
    (PROG ((DSPNOWAITFLG T))
          [COND
            ((OR WAITFLG (EQP DSPTTYCODE 262143))
              (SETQ DSPNOWAITFLG (GETTOPVAL (QUOTE DSPNOWAITFLG]
          (FKCALL DSPLA SUBR CMD (NCHARS CMD))
          (TERPRI))
    (COND                                                                |
      (TEK4025 (MONTEK])
```

[15]

```
(DSPINIT
  [LAMBDA NIL                                                            |
    (SETQ DSPNOWAITFLG NIL)                                              |
    (FKINIT DSPLIB)                                                      |
    (DSPQUIET)                                                           |
    (BKDSPBUF "1.3
1.0
NO
")                                                                       |
                                                                         |
          (* THIS "UNREADS" THE STRING, IE.                              |
          PLACES IT IN THE DISPLAY INPUT BUFFER, SO THAT IT              |
          WILL BE READ BY THE FORTRAN SUBROUTINE DSPLAI)                 |
                                                                         |
    (DSPCNVRT (DSPTTYSTR))                                               |
    (FKSETVAL NTTY 1 (LIST DSPWORD1 DSPWORD2))                           |
    (FKCALL FRTEND SUBR)                                                 |
    (DSPTTY)                                                             |
    (TERPRI])
```

[16]

```
(PRINCHAR
  [LAMBDA (CODE)                                       (* edited:
                                                       "31-Jul-79 20:03")
    (RESETFORM ([LAMBDA (X)
                  (ECHOCONTROL CODE X]
                (QUOTE REAL))
               (PRIN1 (CHARACTER CODE])
```

[17]

```
(UNCRUNCH
  [LAMBDA (NUM)
    (PROG ((PTR SCRATCHFIVE))                    (* CONVERTS A SINGLE
                                                 WORD TO A LIST OF FIVE
                                                 CHAR CODES)
                                                 (* Reuses a scratch list
                                                 for efficiency)
          [RPTQ 5 (PROGN (RPLACA PTR (LRSH NUM 29))
                         (SETN NUM (LLSH NUM 7))
                         (SETQ PTR (CDR PTR]
          (RETURN SCRATCHFIVE])
```

[18]

```
(CRUNCH
  [LAMBDA (X)
    (PROG ((NUM 0))                              (* CONVERTS A LIST OF
                                                 FIVE CHAR CODES TO A
                                                 SINGLE WORD)

          (* If the list is less than 5 chars the extra
          positions are filled with blanks
          (ASCII 32))


          [RPTQ 5 (PROGN (SETN NUM (LOGOR (LLSH NUM 7)
                                          (OR (CAR X)
                                              32)))
                         (SETQ X (CDR X]
          (RETURN (LLSH NUM 1])
```

[19]

```
(DSPCNVRT
  [LAMBDA (X)

          (* Converts an atom or string of up to 10 characters
          into 2 integers corresponding to the FORTRAN
          representation of the chars.
          Pads right with blanks. Returns values bound to
          DSPWORD1 and DSPWORD2.)


    (SETQ X (DCHCON X SCRATCHTEN))
    (SETQ DSPWORD2 (CRUNCH (NTH X 6)))
    (SETQ DSPWORD1 (CRUNCH X])
```

[20]

```
(DSPNUMAT
  [LAMBDA (X)
    (COND
      ((LISTP X)
        (MAPCAR X (FUNCTION DSPNUMAT)))
```

```
      (T (PACKC (UNCRUNCH X])
```

[21]

```
(FKVALAT
  [NLAMBDA (ID BIAS NVALS)
    (DSPNUMAT (APPLY (FUNCTION FKVALI)
                     (LIST ID BIAS NVALS])
```

[22]

```
(DSPADDTRH
  [LAMBDA (NAME ID TYPE)                                    (* NOBIND
                                                            "12-Dec-78 17:30")
    (DSPCNVRT NAME)                                         (* DSPCNVRT returns
                                                            output bound to DSPWORD1
                                                            and DSPWORD2)
    (FKCALL DSPTRH SUBR DSPWORD1 DSPWORD2 (DSPCNVRT ID)
            (DSPCNVRT TYPE])
```

[23]

```
(DSPADDINC
  [LAMBDA (NAME LAT LON TIME)
    (DSPCNVRT NAME)
    (FKCALL DSPINC SUBR DSPWORD1 DSPWORD2 LAT LON TIME])
```

[24]

```
(DSPGRAB
  [LAMBDA (TTYNO)
    (NEQ 1 (COND
           (TTYNO (SETQ DSPTTYCODE (IPLUS 400000Q (OCTSAMEDIGITS TTYNO))
                  )
                  (FKJSYS 70Q DSPTTYCODE))
           (T (SETQ DSPTTYCODE 777777Q])
```

[25]

```
(DSPRELD
  [LAMBDA NIL
    (FKJSYS 57 DSPTTYCODE])
```

[26]

```
(DSPTTY
  [LAMBDA NIL
    (FKJSYS 135 (CAR FORKDATA)
            (LOGOR (LLSH DSPTTYCODE 18)
                   DSPTTYCODE))
    (FKCALL OLDMOD SUBR])
```

[27]

```
(DSPQUIET
  [LAMBDA NIL
    (FKJSYS 135 (CAR FORKDATA)
```

```
            (LOGOR (LLSH DSPTTYCODE 18)
                   131071))
    (FKCALL DSPMOD SUBR])
```

[28]

```
(BKDSPBUF
  [LAMBDA (X)
    (MAPC (CHCON X)
          (FUNCTION (LAMBDA (C)
              (FKJSYS 76 DSPTTYCODE (COND
                        ((EQ C 31)
                          13)
                        (T C])
```

[29]

```
(DECSAMEDIGITS
  [LAMBDA (X)                                    (* Converts an octal
                                                 number to a decimal with
                                                 the same digits)
    (COND
      ((LESSP X 8)
        X)
      (T (IPLUS (IREMAINDER X 8)
                (ITIMES 10 (DECSAMEDIGITS (IQUOTIENT X 8])
```

[30]

```
(OCTSAMEDIGITS
  [LAMBDA (X)

          (* Converts a decimal number, all of whose digits
          are less than eight, to an octal number having the
          same digits)


    (COND
      ((LESSP X 12Q)
        X)
      (T (IPLUS (IREMAINDER X 12Q)
                (ITIMES 10Q (OCTSAMEDIGITS (IQUOTIENT X 12Q])
```

[31]

```
(DSPTTYSTR
  [LAMBDA NIL
    (CONCAT "TTY" [COND
              ((EQP DSPTTYCODE 262143)
                "")
              (T (DECSAMEDIGITS (IDIFFERENCE DSPTTYCODE 131072]
            ":"])
```

[32]

```
(TEKCOM
  [LAMBDA (STR)                                          (* edited:
                                                         "30-Jul-79 19:06")
    (PRIN1 TEKCOMCHAR)
    (PRIN1 STR)
    (TERPRI])
```

[33]

```
(TEKTEST
  [LAMBDA NIL                                            (* edited:
                                                         "10-Aug-79 16:19")
    (PROG (UTEKFLG)
          (CLEARBUF)
          (PRINCHAR 27)
          (PRINCHAR 5)
          (TERPRI)
          (DISMISS 2000)
          (SETQ TEKFLG (READP T))
          (CLEARBUF)
          (PRIN1 "Are you running on a Tektronix?")
          (SETQ UTEKFLG (EQ (ASKUSER)
                            (QUOTE Y)))
          (SETQ TEK4025 NIL)
          [COND
            ((AND UTEKFLG (NOT TEKFLG))
              (PRIN1 "TEK4025? ")
              (SETQ TEK4025 (EQ (ASKUSER)
                                (QUOTE Y)))
              (COND
                (TEK4025 (PRIN1
                           "Please type TEK4025 command character: ")
                         (SETQ TEKCOMCHAR (READ))
                         (CLEARBUF]
          (RETURN (SETQ TEKFLG UTEKFLG])
```

[34]

```
(TEKWAIT
  [LAMBDA NIL                                            (* edited:
                                                         " 9-Feb-79 16:51")
    (COND
      (TEKFLG (JSYS 68 DSPTTYCODE])
```

[35]

```
(DSPERASE
  [LAMBDA NIL                                            (* NOBIND
                                                         "18-Dec-78 17:32")
    (FKCALL ERASE SUBR)
    (TEKWAIT])
```

[36]

```
(DSPEXCH
  [LAMBDA (NAME)
    (RPTQ 10 (RPLSTRING DSPEXCHBUF (ADD1 (ITIMES RPTN 5))
                        (OR (NTHCHAR NAME RPTN)
                            " ")))
    (FKCALL DSPLAX SUBR DSPEXCHBUF])
```

[37]

```
(DSPMAP
  [LAMBDA NIL
    (COND
      ((INFILEP (QUOTE HGHRES.MER))
        (FKSETVAL FLAGS 3 (DSPCNVRT "MAP")))
      (T (PRIN1 "File missing: HGHRES.MER -- Map not available")
         (TERPRI])
```

[38]

```
(DSPNOMAP
  [LAMBDA NIL
    (FKSETVAL FLAGS 3 (DSPCNVRT "NOMAP"])
```

[39]

```
(DSPTOP
  [LAMBDA (WAITFLG)                                    (* edited:
                                                       "31-Jul-79 21:04")
    (PROG ((DSPNOWAITFLG T)
           FIRSTCMD)
          [COND
            ((OR WAITFLG (EQP DSPTTYCODE 262143))
              (SETQ DSPNOWAITFLG (GETTOPVAL (QUOTE DSPNOWAITFLG]
          (RESETLST [COND
                      (TEK4025 (RESETSAVE (GRATEK)
                                          (QUOTE (MONTEK]
                    (FKCALL DSPTOP SUBR])
```

[40]

```
(DSPSTAT
  [LAMBDA NIL
    (FKJSYS 156Q (CAR FORKDATA))
    (LRSH FKJSYSAC1 22Q])
```

[41]

```
(DSPADDINCS
  [LAMBDA (NAME INCLST)
    (DSPCNVRT NAME)
    (MAPC INCLST (FUNCTION (LAMBDA (INC)
              (FKCALL DSPINC SUBR DSPWORD1 DSPWORD2 (CAR INC)
                      (CADR INC)
                      (CADDR INC])
```

[42]

```
(DSPCHGTRH
  [LAMBDA (NAME ID TYPE)
    (DSPQUIET)
    (DSPEXCH NAME)
    (AND ID (FKSETVAL CLOC 26 (DSPCNVRT ID)))
    (AND TYPE (FKSETVAL CLOC 27 (DSPCNVRT TYPE)))
    (FKCALL DSPLAX SUBR DSPEXCHEMP)
    (DSPTTY])
```

[43]

```
(DSPSAVE
  [LAMBDA NIL                                          (* NOBIND
                                                       "20-Dec-78 11:57")
    (FKCALL DREL SUBR)
    (DSPRELD)
    (PROG1 (FKSAVE (QUOTE DSPLIB.EXE))
           (FKKILL])
)
(DECLARE: DONTEVAL@LOAD DOEVAL@COMPILE DONTCOPY COMPILERVARS

(ADDTOVAR NLAMA M)

(ADDTOVAR NLAML FKVALAT)

(ADDTOVAR LAMA )
)

(RPAQQ SCRATCHTEN (0 0 0 0 0 0 0 0 0 0))

(RPAQQ SCRATCHFIVE (0 0 0 0 0))

(RPAQ DSPEXCHBUF (CONCAT
          "                                                    "
                          (CHARACTER 0)))

(RPAQ DSPEXCHEMP (CONCAT
          "     E    M    P    T    Y                        "
                          (CHARACTER 0)))
(DECLARE: DONTCOPY
  (FILEMAP (NIL (1012 9856 (GRATEK 1024 . 1312) (M 1316 . 1404) (MONTEK
1408 . 1526) (DSPCMD 1530 . 2019) (DSPINIT 2023 . 2635) (PRINCHAR 2639 .
 2843) (UNCRUNCH 2847 . 3303) (CRUNCH 3307 . 3848) (DSPCNVRT 3852 . 4357
) (DSPNUMAT 4361 . 4479) (FKVALAT 4483 . 4589) (DSPADDTRH 4593 . 4930) (
DSPADDINC 4934 . 5081) (DSPGRAB 5085 . 5310) (DSPRELD 5314 . 5381) (
DSPTTY 5385 . 5519) (DSPQUIET 5523 . 5655) (BKDSPBUF 5659 . 5838) (
DECSAMEDIGITS 5842 . 6099) (OCTSAMEDIGITS 6103 . 6396) (DSPTTYSTR 6400 .
 6609) (TEKCOM 6613 . 6763) (TEKTEST 6767 . 7771) (TEKWAIT 7775 . 7933)
(DSPERASE 7937 . 8073) (DSPEXCH 8077 . 8266) (DSPMAP 8270 . 8504) (
DSPNOMAP 8508 . 8575) (DSPTOP 8579 . 9047) (DSPSTAT 9051 . 9162) (
DSPADDINCS 9166 . 9423) (DSPCHGTRH 9427 . 9649) (DSPSAVE 9653 . 9853))))
)
STOP
```

```
(FILECREATED "18-Dec-78 16:30:43" <PMORRIS>FORK.LSP.19 40382


     changes to:  FORKCOMS

     previous date: "29-Nov-78 17:47:22" <PMORRIS>FORK.LSP.18)


(PRETTYCOMPRINT FORKCOMS)

(RPAQQ FORKCOMS [(VARS (DSPNOWAITFLG NIL))
        (FNS * FORKFNS)
        [ADDVARS (GLOBALVARS FORKDATA DSPNOWAITFLG)
                 (AFTERSYSOUTFORMS (PROGN (RPLACA FORKDATA NIL)
                                          (FKKILL]
        (P (AND (EQ (EVALV (QUOTE FORKDATA))
                    (QUOTE NOBIND))
                (SETQ FORKDATA NIL)))
        (PROP MACRO FKIDPB FKRACS FKSACS PUTTYP FKHNDL FKHT FKSHR
              FKSYMACS FKDDT FKJFN FKHT_ FKDDT_ FKPROG FKHALT)
        (BLOCKS * FORKBLOCKS)
        (DECLARE: DONTEVAL@LOAD DOEVAL@COMPILE DONTCOPY COMPILERVARS
                  (ADDVARS (NLAMA SAILCALL FKCALL)
                           (NLAML FKSETVAL FKVALI FKVALR FKVAL FKSETA
                                  FKELTR FKELTI FKELT FKARRAY FKX
                                  FKINIT])

(RPAQ DSPNOWAITFLG NIL)

(RPAQQ FORKFNS (FKINIT FKKILL FKSAVE FKDDT FKCALL FKCATYPE FKSR
                       SAILCALL SAILARG SAILSTRING FKACS FKACSRETURN
                       FKRTN NOFORK FKCALLERR FKSW FKX FKTTYSET FKARRAY
                       FKCORGET FKELT FKELTI FKELTR FKSETA FKARRAYP
                       FKARRAYSIZE SAILARRAYSIZE FKARRAYTYPE FKBCHECK
                       FKARRADR FKFLOAT ARRLOC FKVAL FKVALR FKVALI
                       FKSETVAL FKSYM FKSYMPUT FKSYMP GETRADIX50 FKTIME
                       FKJSYS FKJSYSARG FKWAIT))
(DEFINEQ

                                                                  [44]

(FKINIT
  [NLAMBDA (PROGRAM)
    (PROG ((FKACS (ARRAY 20Q 20Q))
           (FKHT (HARRAY 62Q))
           (FKSYMACS (ARRAY 20Q 20Q))
           FKSHR FKJFN FKDDT FKHNDL PGS PROGFILE HALTADR HALTED EV)
          (SETQ PROGFILE
            (OR (INFILEP PROGRAM)
                [AND (NOT (MEMBER (QUOTE %.)
                                  (UNPACK PROGRAM)))
                     (INFILEP (PACK (LIST PROGRAM (QUOTE .EXE]
                (ERROR PROGRAM " FILE NOT FOUND")))
          (AND (EQP (FKJSYS 20Q 100001000000Q (MKSTRING PROGFILE))
                    1)
               (ERROR PROGRAM " -- GTJFN FAILED"))
          (SETQ FKJFN FKJSYSAC1)
```

```
(COND
  ((EQP (FKJSYS 152Q 2000000000000Q)
        1)                                  (* FAILED TO CREATE
                                            FORKNAME)
    (FKJSYS 23Q FKJFN)                      (* RELEASE FKJFN)
    (ERROR PROGRAM " -- CANNOT CREATE FORK")))
(SETQ FKHNDL FKJSYSAC1)
(FKJSYS 200Q (LOGOR (LLSH FKHNDL 22Q)
                    FKJFN))                 (* GET)
(FKJSYS 205Q FKHNDL)                        (* GEVEC)
(SETQ HALTED (LRSH FKJSYSAC2 22Q))          (* HALTED IS A TEMPORARY
                                            VARIABLE HERE)
[COND
  ((OR (ILESSP HALTED 5)
       (IGREATERP HALTED 17Q))
    (FKSW FKHNDL 124Q)                      (* REENTER)
    (FKJSYS 205Q FKHNDL)
    (SETQ HALTED (LRSH FKJSYSAC2 22Q))
                                            (* GEVEC AGAIN)
    (COND
      ((OR (ILESSP HALTED 5)
           (IGREATERP HALTED 17Q))
        (ERROR PROGRAM " -- UNABLE TO INITIALIZE LOWER FORK"]
(SETQ EV FKJSYSAC2)
(SETQ HALTED (RESETFORM (FKTTYSET (QUOTE INITIAL))
                        (FKSW FKHNDL 3)))
                                            (* START THE FORK)
(FKJSYS 204Q FKHNDL EV)
(FKRACS FKHNDL FKACS)
(SETQ HALTADR (ADD1 (ELT FKACS 3)))
(OR (EQP HALTED HALTADR)
    (ERROR PROGRAM " -- INITIALIZATION UNSUCCESSFUL"))
(SETQ PGS (ELT FKACS 2))                    (* NUMBER OF PAGES TO
                                            SHARE)
(AND (IGREATERP PGS 144Q)
     (ERROR PROGRAM " ATTEMPT TO SHARE TOO MANY PAGES"))
[AND (IGREATERP PGS 0)
     (PROG ((LISPBLOCK (LOC (GETBLK PGS)))
            (SIZE (LLSH PGS 11Q))
            SOURCE DEST)
           [SETQ SOURCE (SUB1 (LOGOR -400000000000Q
                                     (LRSH LISPBLOCK 11Q]
           [SETQ DEST (SUB1 (LOGOR (LLSH FKHNDL 22Q)
                                   (ELT FKACS 1]
           (RPTQ PGS (FKJSYS 56Q (IPLUS SOURCE RPTN)
                                 (IPLUS DEST RPTN)
                                 160000000000Q))
           (RETURN (SETQ FKSHR
                         (LIST SIZE
                               (IDIFFERENCE (LLSH (ELT FKACS 1)
                                                  11Q)
                                            LISPBLOCK)
                               (IPLUS LISPBLOCK SIZE)
                               LISPBLOCK]
(SETQ FORKDATA (LIST FKHNDL (LIST FKHT HALTADR)
                     (LIST FKACS)
                     FKSHR FKSYMACS FKDDT FKJFN PROGFILE))
```

```
          (* FORKDATA IS SET TO A LIST OF THE FOLLOWING -
          FKHNDL : The fork handle -
          FKHT : Hash table of fork symbols and names of
          shared arrays (values are fork addresses) -
          FKHALT : Expected PC of fork termination -
          FKJFN : JFN of program in the fork -
          FKACS : List of arrays used to hold acs for fork -
          FKSHR : List containing information about shared
          pages, format is (words-left conversion ending
          start) where words-left is the number of unallocated
          words remaining in the shared pages, conversion is
          the factor to be added to lisp address to get the
          fork address of the first word of the array, ending
          is the lisp address of the word after the block of
          shared pages, and start is the lisp address of the
          first word of the block -
          FKSYMACS : Another AC array for use by FKSYMGET -
          FKDDT : The FKJFN for DDT in the fork.)


          (RETURN PROGFILE])
```

[45]

```
(FKKILL
  [LAMBDA NIL
    (PROG (DDT SHR FKPROG)
          (SELECTQ (EVALV (QUOTE FORKDATA))
                   (NIL (RETURN NIL))
                   (NOBIND (RETURN (SETQ FORKDATA NIL)))
                   NIL)
          (COND
            [(FKHNDL FORKDATA)
              (FKJSYS 156Q (FKHNDL FORKDATA))    (* RFSTS)
              (COND
                ((EQP (RSH FKJSYSAC1 22Q)
                      -1)
                  (SETQ FKPROG NIL))
                (T (SETQ FKPROG (FKPROG FORKDATA))
                   (FKJSYS 153Q (FKHNDL FORKDATA))
                                                  (* KFORK)
                   (FKJSYS 23Q (FKJFN FORKDATA))
                                                  (* RLJFN)
                   (SETQ DDT (FKDDT FORKDATA))
                   (AND DDT (FKJSYS 23Q DDT))    (* RLJFN)
                   ]
            (T (SETQ FKPROG NIL)))
          (SETQ SHR (CDDR (FKSHR FORKDATA)))
          (AND SHR (RELBLK (VAG (CADR SHR))
                           (LRSH (IDIFFERENCE (CAR SHR)
                                              (CADR SHR))
                                 11Q)))
          (SETQ FORKDATA NIL)
          (RETURN FKPROG])
```

[46]

```
(FKSAVE
  [LAMBDA (FILE)                                    (* SAVE A FORK FILE ON
                                                    THE DISK)
    (PROG (JFN)
          (OR (EQ 2 (FKJSYS 20Q -377777000000Q (MKSTRING FILE)))
              (ERROR FILE " -- GTJFN FAILED"))
          (SETQ JFN FKJSYSAC1)
          (FKJSYS 202Q (LOGOR (LLSH (FKHNDL FORKDATA)
                                    22Q)
                              JFN)
                -17777760Q)
          (RETURN (INFILEP FILE])
```

[47]

```
(FKDDT
  [LAMBDA (DDTFILE)
    (PROG (FKHNDL)
          (OR FORKDATA (NOFORK))
          (SETQ FKHNDL (FKHNDL FORKDATA))
          [OR
            (FKDDT FORKDATA                         (* THE MACRO FKDDT))
            (PROGN
              (FKJSYS 47 (LOGOR (LLSH FKHNDL 18)
                                504))                (* CHECK IF DDT WAS
                                                    SAVED WITH THE FORK)
              (AND (ZEROP (LOGAND FKJSYSAC2 1073741824))
                   (PROG (DDT EV)
                         (FKJSYS 133 FKHNDL)        (* SAVE ENTRY VECTOR
                                                    WORD BEFORE DO GET FOR
                                                    DDT)
                         (SETQ EV FKJSYSAC2)
                         (AND (EQP (FKJSYS 16 8590196736
                                           (COND
                                             (DDTFILE (MKSTRING DDTFILE)
                                                      )
                                             (T "<SUBSYS>IDDT.EXE")))
                                   1)
                              (ERROR "" "CANNOT GET JFN FOR DDT"))
                         (SETQ DDT FKJSYSAC1)
                         (FKJSYS 128 (LOGOR (LLSH FKHNDL 18)
                                            DDT))
                         (FKJSYS 132 FKHNDL EV)
                                                    (* RESTORE OLD ENTRY
                                                    VECTOR)
                         (FKDDT_ FORKDATA DDT)
                         (RETURN (FKSW FKHNDL 6))
                                                    (* SET UP $I-1 IN THE
                                                    FORK)
                   ]
          (RESETFORM (FKTTYSET T)
                     (FKSW FKHNDL 258048))          (* START FORK AT DDT
                                                    ENTRY WAIT FOR FORK TO
                                                    HALT)
          (RETURN T])
```

[48]

```
(FKCALL
  [NLAMBDA FKCX                                          (* NOBIND
                                                         "24-Nov-78 13:35")
    (PROG (FKCBP FKCARG FKCTYPE FKCVAL FKCWRDS FKCABP FKHNDL FKHT FKCA
                 FKCRESLIST (FKCID (CAR FKCX))
                 FKBIAS FKRESULT (FKRESULTYPE (CADR FKCX))
                 (FKCARGS (CDDR FKCX))
                 (FKCN 3))
          (OR FORKDATA (NOFORK))
          (SETQ FKHNDL (FKHNDL FORKDATA))
          (SETQ FKHT (FKHT FORKDATA))
          (SETQ FKCA (FKACS))
          (SETQ FKCBP (LOGOR -30014439424 (IPLUS (LOC FKCA)
                                                 2)))
                                                 (* 3 BIT BYTE POINTER TO
                                                 TYPE BITS)
          (SETQ FKCABP (LOGOR -29460791296 (IPLUS (LOC FKCA)
                                                   3)))
                                                 (* FULL WORD BYTE
                                                 POINTER TO FKCA+3)
          (FKWAIT FKHNDL)
          (AND (LISTP FKCID)
               (SETQ FKCID (EVAL FKCID)))
          (FKIDPB (FKSYM FKCID FKHT)
                  FKCABP                                 (* STORE THE ADDRESS OF
                                                         THE SUBPROGRAM IN FKCA
                                                         (2))
                  )
      ARGLOOP
          (OR FKCARGS (GO ARGDONE))
          (SETQ FKCARG (CAR FKCARGS))
          (AND (LISTP FKCARG)
               (SELECTQ (CAR FKCARG)
                        (BIAS (SETQ FKBIAS (EVAL (CADR FKCARG)))
                              (SETQ FKCTYPE (FKCATYPE FKBIAS))
                              [SETQ FKCARG
                                (IPLUS (FKSYM FKBIAS FKHT)
                                       (SUB1 (EVAL (CADDR FKCARG]
                              (GO PUTARG))
                        ((INTEGER REAL LOGICAL)
                          (SETQ FKCRESLIST (CONS (CONS FKCN FKCARG)
                                                 FKCRESLIST))
                          (SETQ FKCARG (CADR FKCARG)))
                        NIL))
          (SETQ FKCARG (EVAL FKCARG))
          (COND
            ((EQ FKCARG T)
              (SETQ FKCARG -1)
              (SETQ FKCTYPE 3))
            ((NULL FKCARG)
              (SETQ FKCARG 0)
              (SETQ FKCTYPE 3))
            ((LITATOM FKCARG)
              (SETQ FKCTYPE (FKCATYPE FKCARG))
```

```
            (SETQ FKCARG (FKSYM FKCARG FKHT)))
           ((FIXP FKCARG)
            (SETQ FKCTYPE 0))
           ((FLOATP FKCARG)
            (SETQ FKCTYPE 2))
           ((STRINGP FKCARG)
            (SETQ FKCWRDS (FKSR FKCA FKCN FKCARG))
            (OR FKCWRDS (FKCALLERR FKCID))
            (GO MWARG))
           ((ARRAYP FKCARG)
            (SETQ FKCWRDS (ARRAYSIZE FKCARG))
            (AND (IGREATERP FKCWRDS (IDIFFERENCE 17 FKCN))
                 (FKCALLERR FKCID))
            (RPTQ FKCWRDS (SETA FKCA (IPLUS FKCN RPTN -1)
                                (ELT FKCARG RPTN)))
            (GO MWARG))
           ((LISTP FKCARG)
            (ERROR FKCARG
               "LISTS CANNOT BE USED AS ARGUMENTS FOR FORK CALLS"))
           [(FKARRAYP FKCARG)
            (SETQ FKCTYPE (COND
                ((EQ (FKARRAYTYPE FKCARG)
                     (QUOTE REAL))
                  4)
                (T 1)))
            (SETQ FKCARG (IPLUS (LOC FKCARG)
                                (CADR (FKSHR FORKDATA]
           (T (ERROR FKCARG " ILLEGAL ARG TYPE FOR FORK CALL")))
      PUTARG
          (AND (IGREATERP FKCN 16)
               (FKCALLERR FKCID))
          (FKIDPB FKCARG FKCABP                    (* STORE VALUE OF FKCARG
                                                   INTO FKCA))
          (SETQ FKCN (ADD1 FKCN))
          (FKIDPB FKCTYPE FKCBP                    (* PUT TYPE))
      ENDARG
          (SETQ FKCARGS (CDR FKCARGS))
          (GO ARGLOOP)
      MWARG
          (SETQ FKCN (IPLUS FKCN FKCWRDS))
          (PUTTYP 0)
          (SETQ FKCABP (IPLUS FKCABP FKCWRDS))
          (RPTQ (SUB1 FKCWRDS)
                (PUTTYP 5))
          (GO ENDARG)
      ARGDONE
          (PUTTYP 6)                               (* END OF ARGS)
          (FKSACS FKHNDL FKCA)
          (FKSW FKHNDL 5 T)
          (AND DSPNOWAITFLG (RETURN))
          (AND (LISTP FKRESULTYPE)
               (SETQ FKRESULTYPE (EVAL FKRESULTYPE)))
          (AND (EQ FKRESULTYPE (QUOTE SUBR))
               (NULL FKCRESLIST)
               (PROGN (FKACSRETURN FKCA)
                      (RETURN NIL)))
          (FKRACS FKHNDL FKCA)
```

```
          [MAPC FKCRESLIST (FUNCTION (LAMBDA (X)
                    (SET (CADDR X)
                         (FKRTN (CADR X)
                                FKCA
                                (CAR X]
          (SETQ FKRESULT (FKRTN FKRESULTYPE FKCA 1))
          (FKACSRETURN FKCA)
          (RETURN FKRESULT])
```

[49]

```
(FKCATYPE
  [LAMBDA (FKID)
    (PROG ((C (CHCON1 FKID)))

          (* IF FIRST CHARACTER OF PNAME OF FKID IS IN I TO N,
          THEN TYPE IS POINTER TO INTEGER, ELSE POINTER TO
          REAL)


          (RETURN (COND
                    ([OR (ILESSP C (CHCON1 (QUOTE I)))
                         (IGREATERP C (CHCON1 (QUOTE N]
                      4)
                    (T 1])
```

[50]

```
(FKSR
  [LAMBDA (A I STR)
    (PROG [WDS (DESTPTR (LOGOR 700000000Q (IPLUS (LOC A)
                                                 I)))
               (SIZE (NCHARS STR))
               (ROOM (IDIFFERENCE (ARRAYSIZE A)
                                  (SUB1 I]

          (* A IS ARRAY POINTER. I IS INDEX WHERE START
          PUTTING STRING, STR. IF STR IS TOO LARGE THEN RETURN
          NIL, ELSE RETURN NUMBER OF WORDS USED.
          PUTS ZERO WORD AFTER THE STRING)


          (SETQ WDS (ADD1 (IQUOTIENT (IPLUS SIZE 4)
                                     5)))
          (AND (IGREATERP WDS ROOM)
               (RETURN))                          (* DOESN'T FIT)
          (RPTQ WDS (SETA A (IPLUS I RPTN -1)
                            0))
          (FKJSYS 53Q DESTPTR STR (IMINUS SIZE))
                                                  (* SOUT)
          (RETURN WDS])
```

[51]

```
(SAILCALL
  [NLAMBDA FKCX
    (PROG (FKCBP FKCABP FKHNDL FKHT FKCA FKCRESLIST FKRESULT
```

```
                FKRESULTBITS FKCARG FKTYPE (FKCID (CAR FKCX))
                (FKRESULTYPE (CADR FKCX))
                (FKCARGS (CDDR FKCX))
                (FKCN 4))
          [SETQ FKHNDL (FKHNDL (OR FORKDATA (NOFORK]
          (SETQ FKHT (FKHT FORKDATA))
          (SETQ FKCA (FKACS))
          (SETQ FKCBP (LOGOR -337400000000Q (IPLUS (LOC FKCA)
                                                   3)))
                                                (* 4 BIT BYTE POINTER TO
                                                FKTYPE BITS)
          (SETQ FKCABP (LOGOR -333400000000Q (IPLUS (LOC FKCA)
                                                    5)))
                                                (* FULL WORD BYTE
                                                POINTER TO ARGUMENT
                                                LIST)
          (COND
            [(FMEMB FKRESULTYPE (QUOTE (SUBR REAL INTEGER BOOLEAN
                                                LOGICAL]
            ((EQ FKRESULTYPE (QUOTE STRING))
              (ERROR FKRESULTYPE
                     "STRING PROCEDURES NOT IMPLEMENTED YET"))
            (T (ERROR FKRESULTYPE "ILLEGAL TYPE FOR SAIL CALL")))
          (SETQ FKRESULTBITS (COND
              (FKTTYSETCALLED -1000000000Q)
              (T 0)))
          (SETA FKCA 1 (LOGOR FKRESULTBITS (FKSYM FKCID FKHT)))
        ARGLOOP
          (OR FKCARGS (GO ARGDONE))
          (SETQ FKCARG (SAILARG (CAR FKCARGS)
                                FKHT))
          (SETQ FKTYPE (CAR FKCARG))
          (AND (CADDR FKCARG)
               (SETQ FKCRESLIST (CONS (CONS FKCN (CADDR FKCARG))
                                      FKCRESLIST)))
          (SETQ FKCARG (CADR FKCARG))
          [COND
            ((ATOM FKCARG)
              (AND (IGREATERP FKCN 20Q)
                   (FKCALLERR FKCID))
              (FKIDPB FKCARG FKCABP)
              (SETQ FKCN (ADD1 FKCN))
              (FKIDPB FKTYPE FKCBP))
            (T (AND (IGREATERP (SETQ FKCN (IPLUS FKCN (LENGTH FKCARG)))
                               21Q)
                    (FKCALLERR FKCID))
               (MAPC FKCARG (FUNCTION (LAMBDA (WORD)
                         (FKIDPB WORD FKCABP)
                         (FKIDPB FKTYPE FKCBP)
                         (SETQ FKTYPE 14Q]
          (SETQ FKCARGS (CDR FKCARGS))
          (GO ARGLOOP)
        ARGDONE
          (PUTTYP 15Q)                          (* END OF ARGS)
          (FKSACS FKHNDL FKCA)
          (FKSW FKHNDL 7)                       (* CALL THE FUNCTION)
          (AND (EQ FKRESULTYPE (QUOTE SUBR))
```

```
            (NULL FKCRESLIST)
            (PROGN (FKACSRETURN FKCA)
                   (RETURN NIL)))
          (FKRACS FKHNDL FKCA)
          [MAPC FKCRESLIST (FUNCTION (LAMBDA (X)
                (SET (CADDR X)
                     (FKRTN (CADR X)
                            FKCA
                            (CAR X]
          (SETQ FKRESULT (FKRTN FKRESULTYPE FKCA 1))
          (FKACSRETURN FKCA)
          (RETURN FKRESULT])
```

[52]

```
(SAILARG
  [LAMBDA (FKARG FKHT)

          (* FKTYPE BITS -- 1 : STRING, 2 : REFERENCE
          (TO PROCEDURE), 4 : REFERENCE
          (TO LOWER FORK), 10Q : FKARRY)


    (PROG ((FKRV (QUOTE VALUE))
           (FKTYPE 0)
           FKARRY VARTYPE FKVALUE FKRESULTS FKVARBL FKCALLTYPE)
          [COND
            [[AND (LISTP FKARG)
                  (ATOM (CAR FKARG))
                  (FMEMB (CAR FKARG)
                         (QUOTE (REFERENCE VALUE INTEGER REAL BOOLEAN
                                           LOGICAL STRING ARRAY]
              (SETQ FKVARBL (CAR (LAST FKARG]
            (T (SETQ FKVARBL FKARG)
               (SETQ FKARG (LIST FKARG]
          (SETQ FKVALUE (EVAL FKVARBL))          (* INSPECT THE ARGUMENT)
          (COND
            ((EQ FKVALUE T)
              (SETQ FKVALUE -1)
              (SETQQ VARTYPE INTEGER))
            ((EQ FKVALUE NIL)
              (SETQ FKVALUE 0)
              (SETQQ VARTYPE INTEGER))
            ((LITATOM FKVALUE)
              (SETQ FKVALUE (FKSYM FKVALUE FKHT))
              (SETQ FKTYPE 4))
            ((STRINGP FKVALUE)
              (SETQ FKVALUE (SAILSTRING FKVALUE))
              (SETQQ VARTYPE STRING))
            ((FKARRAYP FKVALUE)
              [SETQ FKVALUE (IPLUS (LOC FKVALUE)
                                   (CADR (FKSHR FORKDATA]
              (SETQ FKTYPE 12Q))
            ((FIXP FKVALUE)
              (SETQQ VARTYPE INTEGER))
            ((FLOATP FKVALUE)
              (SETQQ VARTYPE REAL))
```

```
            ((LISTP FKVALUE)
              (ERROR FKVALUE
                 "LISTS CANNOT BE USED AS ARGUMENTS FOR FORK CALLS"))
              (T (ERROR FKVALUE "ILLEGAL ARG TYPE FOR SAIL CALL")))
                                                  (* INSPECT THE
                                                  MODIFIERS)
          (SETQ FKCALLTYPE (OR VARTYPE (QUOTE INTEGER)))
          [MAP FKARG (FUNCTION (LAMBDA (X)
                    (AND (CDR X)
                         (SELECTQ (CAR X)
                                  (REFERENCE (SETQQ FKRV REFERENCE))
                                  (VALUE (SETQQ FKRV VALUE))
                                  (INTEGER (SETQQ FKCALLTYPE INTEGER))
                                  (REAL (SETQQ FKCALLTYPE REAL))
                                  ((BOOLEAN LOGICAL)
                                    (SETQQ FKCALLTYPE LOGICAL))
                                  (STRING (SETQQ FKCALLTYPE STRING))
                                  (ARRAY (SETQ FKARRY T))
                                  (ERROR (CAR X)

                                "ILLEGAL ARGUMENT TYPE FOR SAIL CALL"]
                                                  (* PERFORM FKTYPE
                                                  CONVERSIONS)
          [AND VARTYPE (NEQ FKCALLTYPE VARTYPE)
               (PROGN (COND
                         ((EQ VARTYPE (QUOTE STRING))
                           (SETQ FKVALUE (LLSH (CAR FKVALUE)
                                               -35Q))
                           (SETQQ VARTYPE INTEGER)))
                       (COND
                         ((AND (EQ VARTYPE (QUOTE REAL))
                               (EQ FKCALLTYPE (QUOTE INTEGER)))
                           (SETQ FKVALUE (FIX FKVALUE)))
                         ((AND (EQ VARTYPE (QUOTE INTEGER))
                               (EQ FKCALLTYPE (QUOTE REAL)))
                           (SETQ FKVALUE (FLOAT FKVALUE)))
                         ((EQ FKCALLTYPE (QUOTE STRING))
                           (AND (EQ VARTYPE (QUOTE REAL))
                                (SETQ FKVALUE (FIX FKVALUE)))
                           (SETQ FKVALUE (LLSH FKVALUE 35Q]
                                                  (* SET FKTYPE BITS)
          (AND (EQ FKCALLTYPE (QUOTE STRING))
               (SETQ FKTYPE (LOGOR FKTYPE 1)))
          (AND (EQ FKRV (QUOTE REFERENCE))
               (SETQ FKTYPE (LOGOR FKTYPE 2))
               (LITATOM FKVARBL)
               (SETQ FKRESULTS (LIST FKCALLTYPE FKVARBL)))
          (AND FKARRY (SETQ FKTYPE (LOGOR 12Q FKTYPE)))
          (RETURN (LIST FKTYPE FKVALUE FKRESULTS])
```

[53]

```
(SAILSTRING
  [LAMBDA (STRING)                                (* THIS COULD PROBABLY
                                                  BE DONE MUCH MORE
                                                  QUICKLY)
    (PROG (VAL ZEROS CHLIST PACKEDLIST)
```

```
        (SETQ CHLIST (CHCON STRING))
      STRINGLOOP
        [OR CHLIST (PROGN (OR ZEROS (SETQ PACKEDLIST
                                    (CONS 0 PACKEDLIST)))
                          (RETURN (REVERSE PACKEDLIST]
        (SETQ VAL 0)
        [RPTQ 5 (PROGN (SETQ VAL (IPLUS (LLSH VAL 7)
                                        (OR (CAR CHLIST)
                                            0)))
                       (OR (CAR CHLIST)
                           (SETQ ZEROS T))
                       (SETQ CHLIST (CDR CHLIST]
        (SETQ PACKEDLIST (CONS (LLSH VAL 1)
                               PACKEDLIST))
        (GO STRINGLOOP])
```

[54]

```
(FKACS
  [LAMBDA NIL
    (PROG ((Y (CDDR FORKDATA))
           X)
          (RETURN (COND
                    ((SETQ X (CAR Y))
                      (RPLACA Y (CDR X))
                      (CAR X))
                    (T (ARRAY 20Q 20Q])
```

[55]

```
(FKACSRETURN
  [LAMBDA (ARRAY)
    (PROG ((Y (CDDR FORKDATA)))
          (RETURN (RPLACA Y (CONS ARRAY (CAR Y])
```

[56]

```
(FKRTN
  [LAMBDA (TYPE A N)
    (SELECTQ TYPE
             (INTEGER (ELT A N))
             (REAL (ASSEMBLE NIL
                             (CQ (VAG (IPLUS (LOC A)
                                             N)))
                             (MOVE 1 , 1 (1))
                             (FASTCALL MKFN)))
             [LOGICAL (NOT (ZEROP (ELT A N]
             (SUBR NIL)
             (ERROR TYPE "ILLEGAL RESULT TYPE FOR FORK CALL"])
```

[57]

```
(NOFORK
  [LAMBDA NIL
    (PRIN1 "NO FORK!
PROGRAM NAME: ")
    (APPLY* (FUNCTION FKINIT)
```

```
            (READ))
    FORKDATA])
```

[58]

```
(FKCALLERR
  [LAMBDA (FKCID)
    (ERROR FKCID " TOO MANY WORDS OF ARGS FOR A FORK CALL"])
```

[59]

```
(FKSW
  [LAMBDA (FKHNDL I FKNOWAITFLG)                    (* NOBIND
                                                    "24-Nov-78 12:43")
    (PROG ((EXPECTED (FKHALT FORKDATA))
           HALTED)
          (COND
            ((ILESSP I 33)
              (FKJSYS 129 FKHNDL I)                 (* SFRKV)
             )
            (T (FKJSYS 111 FKHNDL I)                (* SFORK)
             ))
          (AND FKNOWAITFLG DSPNOWAITFLG (RETURN EXPECTED))
          (FKJSYS 115 FKHNDL)                       (* WFORK)
          (FKJSYS 110 FKHNDL)                       (* RFSTS)
          (SETQ HALTED (LOGAND FKJSYSAC2 262143))
          (AND EXPECTED (NULL (EQP HALTED EXPECTED))
               (RESETFORM (RADIX 8)
                          (HELP "LOWER FORK HALTED AT ADDRESS: " HALTED)
                          ))
          (RETURN HALTED])
```

[60]

```
(FKX
  [NLAMBDA (FKCX)
    (EVAL (LIST (QUOTE RESETFORM)
                (QUOTE (FKTTYSET T))
                FKCX])
```

[61]

```
(FKTTYSET
  [LAMBDA (BOOL)

          (* IF BOOL IS T, DISARMS LISP CONTROL CHARACTER
          INTERRUPTS, EXCEPT FOR ^B, ^D, ^E, AND ^H.
          IF BOOL IS NIL, RESTORES INTERRUPTS AND TERMINAL
          CHARACTERISTICS)


    (COND
      ((EQ BOOL (QUOTE INITIAL))
        (FKJSYS 112Q 101Q)                          (* RFCOC)
        (SETQ FKCC1 FKJSYSAC2)
        (SETQ FKCC2 FKJSYSAC3)
        (FKJSYS 107Q 101Q)                          (* RFMOD)
```

```
        (SETQ FKFMOD FKJSYSAC2)
        (FKJSYS 173Q 400000Q)                          (* RTIW)
        (SETQ FKTIW FKJSYSAC2)
        (FKJSYS 174Q 400000Q 1310000000000Q)           (* STIW FOR ^B, ^D, ^E,
                                                       AND ^H)
        (SETQ FKTTYSETCALLED T)
        NIL)
      (BOOL (FKJSYS 174Q 400000Q 1310000000000Q)
                                                       (* STIW)
          (SETQ FKTTYSETCALLED T)
          NIL)
      (T (FKJSYS 113Q 101Q FKCC1 FKCC2)                (* SFCOC)
         (FKJSYS 110Q 101Q FKFMOD)                     (* SFMOD)
         (FKJSYS 174Q 400000Q FKTIW)                   (* STIW)
         (SETQ FKTTYSETCALLED NIL)
         T])
```

[62]

```
(FKARRAY
  [NLAMBDA (FKA FKTYPE FKSIZE FKSIZE2)
    (PROG ((FKOFFSET 0)
           (FKTOTALSIZE 1)
           (FKNDIM 0)
           [FKSIZES (COND
                      ((NLISTP FKSIZE)
                        (EVAL FKSIZE))
                      ((GETD (CAR FKSIZE))
                        (EVAL FKSIZE))
                      (T (MAPCAR FKSIZE (FUNCTION EVAL]
           FKDIMS FKDOPE FKHI FKLO FKBYTP FKDATAWD FKLOC)
          (OR FORKDATA (NOFORK))
          (SETQ FKTYPE (SELECTQ FKTYPE
                                (REAL -1)
                                (INTEGER 0)
                                (ERROR FKA
                                    " HAS ILLEGAL TYPE DECLARATION")))
          (COND
            (FKSIZE2 (SETQ FKHI (EVAL FKSIZE2))
                     (SETQ FKOFFSET (ADD1 FKSIZES))
                     (SETQ FKNDIM 2)
                     (SETQ FKTOTALSIZE (ITIMES FKSIZES FKHI))
                     (SETQ FKDOPE (LIST 1 FKSIZES 1 FKSIZES FKHI 1))
                     (GO FKDIMDONE)))
          [SETQ FKDIMS (COND
              ((LISTP FKSIZES)
                (REVERSE FKSIZES))
              (T (LIST FKSIZES 1]
      FKDIMLOOP
          (OR (AND (NUMBERP (SETQ FKHI (CAR FKDIMS)))
                   (NUMBERP (SETQ FKLO (CADR FKDIMS)))
                   (NOT (ILESSP FKHI FKLO)))
              (ERROR FKSIZES "INVALID INDEX SPECIFICATION"))
          [SETQ FKDOPE (CONS FKTOTALSIZE (CONS FKHI (CONS FKLO FKDOPE]
          (SETQ FKOFFSET (IPLUS FKOFFSET (ITIMES FKTOTALSIZE FKLO)))
          (SETQ FKNDIM (ADD1 FKNDIM))
          [SETQ FKTOTALSIZE (ITIMES FKTOTALSIZE
```

```
                                        (ADD1 (IDIFFERENCE FKHI FKLO]
            (AND (SETQ FKDIMS (CDDR FKDIMS))
                 (GO FKDIMLOOP))
          FKDIMDONE
            (SETQ FKLOC (FKCORGET (IPLUS FKTOTALSIZE (ITIMES FKNDIM 3)
                                         4)))
            (SETQ FKBYTP (LOGOR -3334000000000Q FKLOC))
            (FKIDPB (SETQ FKDATAWD (IPLUS FKLOC (ITIMES FKNDIM 3)
                                         4))
                    FKBYTP)                          (* POINTS TO FIRST DATA
                                                     WORD)
            (FKIDPB FKTYPE FKBYTP)                   (* TYPE -- POINTS TO
                                                     LITERAL ATOM -- SHOULDNT
                                                     MOVE DURING GARBAGE
                                                     COLLECTION)
            [FKSYMPUT (FKHT FORKDATA)
                      FKA
                      (IPLUS FKDATAWD (CADR (FKSHR FORKDATA]
            (FKIDPB (IPLUS FKDATAWD (CADR (FKSHR FORKDATA))
                           (IMINUS FKOFFSET))
                    FKBYTP)                          (* BASE ADDRESS FOR SAIL
                                                     ADDRESS CALCULATION)
            [MAPC (REVERSE FKDOPE)
                  (FUNCTION (LAMBDA (WORD)
                      (FKIDPB WORD FKBYTP]           (* FOR EACH DIMENSION,
                                                     LOWERBOUND, UPPER BOUND,
                                                     MULTIPLIER)
            (FKIDPB (LOGOR (LLSH FKNDIM 22Q)
                           FKTOTALSIZE)
                    FKBYTP)                          (* XWD NDIMS,,TOTAL
                                                     FKTOTALSIZE)
            (RETURN (SET FKA (VAG FKDATAWD]
```

[63]

```
(FKCORGET
  [LAMBDA (SIZE)
    (PROG ((SHR (FKSHR FORKDATA))
           X)
          (AND (IGREATERP SIZE (CAR SHR))
               (ERROR (FKPROG FORKDATA)
                      " SHARED PAGES EXCEEDED"))
          (SETQ X (IDIFFERENCE (CADDR SHR)
                               (CAR SHR)))
          (RPLACA SHR (IDIFFERENCE (CAR SHR)
                                   SIZE))
          (RETURN X])
```

[64]

```
(FKELT
  [NLAMBDA (FKELT!A FKELT!N FKELT!WORDS)
    (APPLY* (SELECTQ (FKARRAYTYPE (EVAL FKELT!A))
                     (REAL (FUNCTION FKELTR))
                     (INTEGER (FUNCTION FKELTI))
                     (QUOTE ARRAYSCLOBBERED!))
            FKELT!A FKELT!N FKELT!WORDS])
```

[65]

```
(FKELTI
  [NLAMBDA (FKELTI!A FKELTI!N FKELTI!WORDS)
    (PROG (PTR ANS)
          (SETQ FKELTI!WORDS (EVAL FKELTI!WORDS))
          (SETQ PTR (FKARRADR FKELTI!A FKELTI!N FKELTI!WORDS))
          (RETURN (COND
                    [FKELTI!WORDS (RPTQ FKELTI!WORDS
                                        (SETQ ANS
                                          (CONS (OPENR (IPLUS PTR RPTN
                                                              -1))
                                                ANS]
                    (T (OPENR PTR])
```

[66]

```
(FKELTR
  [NLAMBDA (FKELTR!A FKELTR!N FKELTR!WORDS)
    (PROG (PTR ANS)
          (SETQ FKELTR!WORDS (EVAL FKELTR!WORDS))
          (SETQ PTR (FKARRADR FKELTR!A FKELTR!N FKELTR!WORDS))
          (RETURN (COND
                    [FKELTR!WORDS (RPTQ FKELTR!WORDS
                                        (SETQ ANS
                                          (CONS (FKFLOAT (IPLUS PTR
                                                                RPTN -1))
                                                ANS]
                    (T (FKFLOAT PTR])
```

[67]

```
(FKSETA
  [NLAMBDA (FKARRY FKINDEX FKEXPR)
    (PROG (FKPTR FKVAL)
          (SETQ FKVAL (EVAL FKEXPR))
          [SETQ FKPTR (FKARRADR FKARRY FKINDEX (AND (LISTP FKVAL)
                                                    (LENGTH FKVAL]
          (RETURN (COND
                    [(LISTP FKVAL)
                      (MAPCAR FKVAL (FUNCTION (LAMBDA (FKV)
                                        (PROG1 (CLOSER FKPTR FKV)
                                               (SETQ FKPTR (ADD1 FKPTR]
                    ((CLOSER FKPTR FKVAL)
                      FKVAL])
```

[68]

```
(FKARRAYP
  [LAMBDA (A)
    (PROG [(SHR (CDDR (FKSHR FORKDATA]
          (RETURN (AND SHR (IGREATERP (CAR SHR)
                                      (LOC A))
                           (NOT (IGREATERP (CADR SHR)
                                           (LOC A)))
                           A])
```

[69]

```
(FKARRAYSIZE
  [LAMBDA (A)
    (LOGAND 777777Q (OPENR (SUB1 (LOC A])
```

[70]

```
(SAILARRAYSIZE
  [LAMBDA (A)
    (PROG ((X (LOC A))
           ANS NDIM)
          (SETQ NDIM (LRSH (OPENR (SUB1 X))
                           22Q))
          [RPTQ NDIM (PROGN (SETQ X (IDIFFERENCE X 3))
                            (SETQ ANS
                              (CONS (OPENR X)
                                    (CONS (OPENR (SUB1 X))
                                          ANS]
          (RETURN (REVERSE ANS])
```

[71]

```
(FKARRAYTYPE
  [LAMBDA (A)
    (PROG (NDIM)
          (SETQ NDIM (LRSH (OPENR (SUB1 (LOC A)))
                           22Q))
          (RETURN (COND
                    ([ZEROP (OPENR (IDIFFERENCE (LOC A)
                                                (IPLUS (ITIMES NDIM 3)
                                                       3]
                      (QUOTE INTEGER))
                    (T (QUOTE REAL])
```

[72]

```
(FKBCHECK
  [LAMBDA (N LO HI)
    (AND (OR (IGREATERP N HI)
             (ILESSP N LO))
         (ERROR N " INDEX OUT OF RANGE"])
```

[73]

```
(FKARRADR
  [LAMBDA (FKARRNAME FKINDEX FKNWORDS)
    (PROG ((FKARRY (EVAL FKARRNAME))
           FKADR FKNDIM FKSIZE FKLOW (FKOFFSET 0)
           FKDIMS FKPTR)
          (OR (FKARRAYP FKARRY)
              (ERROR FKARRY " -- ARG NOT SHARED ARRAY"))
          (SETQ FKADR (LOC FKARRY))
          [SETQ FKDIMS (COND
              ((NLISTP FKINDEX)
                (EVAL FKINDEX))
```

```
            ((GETD (CAR FKINDEX))
              (EVAL FKINDEX))
            (T (MAPCAR FKINDEX (FUNCTION EVAL]
          [COND
            ((NUMBERP FKDIMS)
              [SETQ FKSIZE (LOGAND 777777Q (OPENR (SUB1 FKADR]
              (FKBCHECK FKDIMS 1 FKSIZE)
              (SETQ FKOFFSET (SUB1 FKDIMS)))
            (T (SETQ FKNDIM (LRSH (OPENR (SUB1 FKADR))
                                  22Q))
               (OR (EQP FKNDIM (LENGTH FKDIMS))
                   (ERROR FKINDEX
                          " WRONG NUMBER OF DIMENSIONS FOR ARRAY"))
               (SETQ FKPTR FKADR)
               [MAPC FKDIMS (FUNCTION (LAMBDA (X)
                         (SETQ FKPTR (IDIFFERENCE FKPTR 3))
                         (SETQ FKLOW (OPENR (SUB1 FKPTR)))
                         (FKBCHECK X FKLOW (OPENR FKPTR))
                         (SETQ FKOFFSET
                           (IPLUS FKOFFSET (ITIMES (OPENR (ADD1 FKPTR))
                                                   (IDIFFERENCE X FKLOW]
               (AND FKNWORDS (SETQ FKSIZE (LOGAND 777777Q
                                                  (OPENR (SUB1 FKADR]
          (AND FKNWORDS (FKBCHECK (IPLUS FKOFFSET FKNWORDS)
                                  1 FKSIZE))
          (RETURN (IPLUS FKADR FKOFFSET])
```

[74]

```
(FKFLOAT
  [LAMBDA (ADR)
    (ASSEMBLE NIL
              (CQ (VAG ADR))
              (MOVE 1 , 0 (1))
              (FASTCALL MKFN])
```

[75]

```
(ARRLOC
  [LAMBDA (ARR)
    (COND
      ((ARRAYP ARR)
        (IPLUS 2 (LOC ARR)))
      ((FKARRAYP ARR)
        (LOC ARR))
      ((ERROR ARR "ARG NOT ARRAY"])
```

[76]

```
(FKVAL
  [NLAMBDA (FKADR FKBIAS FKWORDS)
    (APPLY* (FUNCTION FKVALI)
            FKADR FKBIAS FKWORDS (COND
              ((EQ (FKCATYPE FKADR)
                   4)
                (QUOTE REAL])
```

[77]

```
(FKVALR
  [NLAMBDA (FKADR FKBIAS FKWORDS)
    (APPLY* (FUNCTION FKVALI)
            FKADR FKBIAS FKWORDS (QUOTE REAL])
```

[78]

```
(FKVALI
  [NLAMBDA (FKADR FKBIAS FKWORDS FKREAL)          (* NOBIND
                                                  "24-Nov-78 12:58")
    (PROG (FKHNDL FKHT FKACS FKBP FKRESULT)
          (OR FORKDATA (NOFORK))
          (SETQ FKHNDL (FKHNDL FORKDATA))
          (FKWAIT FKHNDL)                                          |
          (SETQ FKHT (FKHT FORKDATA))
          (SETQ FKACS (FKACS))
          (SETQ FKBP (LOGOR -29460791296 (IPLUS (LOC FKACS)        |
                                                2)))               |
                                                (* FULL WORD POINTER TO
                                                FIRST WORD OF FKACS)   |
          (FKIDPB 15032385536 FKBP)             (* ONE ARGUMENT, POINTER
                                                TYPE)
          (FKIDPB (FKSYM (QUOTE FKVAL)
                         FKHT)
                  FKBP)
          (FKIDPB (IPLUS -1 (OR (EVAL FKBIAS)
                                1)
                            (FKSYM FKADR FKHT))
                  FKBP)                         (* ADDRESS OF COMMON OR
                                                VARIABLE)
          (FKSACS FKHNDL FKACS)
          (FKSW FKHNDL 5)
          (FKRACS FKHNDL FKACS)
          (SETQ FKBP (IPLUS (LOC FKACS)
                            4))
          [COND
            [FKWORDS (SETQ FKWORDS (EVAL FKWORDS))
                     (COND
                       ((IGREATERP FKWORDS 14)
                         (HELP FKWORDS
" --  TOO MANY WORDS FOR FKVAL
TYPE %"RETURN)%" TO GET FIRST 14 WORDS")
                         (SETQ FKWORDS 14)))
                     (RPTQ FKWORDS
                           (SETQ FKRESULT
                             (CONS [COND
                                     (FKREAL (FKFLOAT (IPLUS FKBP RPTN
                                                             -1)))
                                     ((OPENR (IPLUS FKBP RPTN -1]
                                   FKRESULT]
            (FKREAL (SETQ FKRESULT (FKFLOAT FKBP)))
            ((SETQ FKRESULT (OPENR FKBP]
          (FKACSRETURN FKACS)
          (RETURN FKRESULT])
```

```
(FKSETVAL
  [NLAMBDA (FKADR FKBIAS FKVAL)                    (* NOBIND
                                                   "24-Nov-78 13:00")
    (PROG (FKHNDL FKHT FKACS FKBP FKRESULT)
          (OR FORKDATA (NOFORK))
          (SETQ FKHNDL (FKHNDL FORKDATA))
          (FKWAIT FKHNDL)
          (SETQ FKHT (FKHT FORKDATA))
          (SETQ FKACS (FKACS))
          (SETQ FKBP (LOGOR -29460791296 (IPLUS (LOC FKACS)
                                                2)))
                                                (* FULL WORD POINTER TO
                                                FIRST WORD OF FKACS)
          (FKIDPB 8685804397 FKBP)              (* ARGUMENT BITS)
          (FKIDPB (LOGOR -19595788288 (FKSYM (QUOTE FKSETV)
                                             FKHT))
                  FKBP)
          (FKIDPB (IPLUS -1 (EVAL FKBIAS)
                           (FKSYM FKADR FKHT))
                  FKBP)                         (* ADDRESS OF COMMON OR
                                                VARIABLE)
          (SETQ FKVAL (EVAL FKVAL))
          (OR (LISTP FKVAL)
              (SETQ FKVAL (LIST FKVAL)))
          (COND
            ((IGREATERP (LENGTH FKVAL)
                        12)
              (HELP (LENGTH FKVAL)

" --  TOO MANY WORDS FOR FKSETVAL
TYPE %"RETURN)%" TO SET FIRST 12 WORDS")
              (SETQ FKVAL (COPY FKVAL))
              (RPLACD (NTH FKVAL 12)
                      NIL)))
          (FKIDPB (LENGTH FKVAL)
                  FKBP)
          [MAPC FKVAL (FUNCTION (LAMBDA (VAL)
                      (FKIDPB (COND
                                ((NUMBERP VAL)
                                  VAL)
                                ((NULL VAL)
                                  0)
                                ((EQ VAL T)
                                  -1)
                                (T (ERROR VAL
                                     " -- NON-NUMERIC ARG IN FKSETVAL")))
                              FKBP]
          (FKSACS FKHNDL FKACS)
          (FKSW FKHNDL 5)
          (FKACSRETURN FKACS)
          (RETURN FKVAL])
```

```
(FKSYM
  [LAMBDA (ID FKHT NOBREAK)

          (* LOOKS FOR ID IN FORK HASH TABLE.
          IF CANNOT FIND, THEN GOES TO FORK DDT TO LOOK IT
          UP.)
```

```
    [OR FKHT (SETQ FKHT (FKHT (OR FORKDATA (NOFORK]
    (OR (FIXP ID)
        (GETHASH ID FKHT)
        (PROG (P FKHNDL)                          (* GETS DEFINITION OF ID
                                                  FROM DDT FOR THE
                                                  FORKNAME)
              (SETQ P (FKSYMACS FORKDATA))
              (SETQ FKHNDL (FKHNDL FORKDATA))
              (SETA P 1 (GETRADIX50 ID))
              (FKSACS FKHNDL P)
              (FKSW FKHNDL 4)
              (FKRACS FKHNDL P)
              [AND (ZEROP (ELT P 1))
                   (COND
                     (NOBREAK (RETURN NIL))
                     (T (ERROR ID " NOT DEFINED IN FORK"]
              (RETURN (FKSYMPUT FKHT ID (ELT P 2])
                                                                        [81]


(FKSYMPUT
  [LAMBDA (FKHT ID V)
    (PROG ((HTL (LIST FKHT)))
          (PUTHASH ID V HTL)                      (* EXPANDS HT IF
                                                  NECESSARY)
          (FKHT_ FORKDATA (CAR HTL))
          (RETURN V])
                                                                        [82]


(FKSYMP
  [LAMBDA (ID)
    (FKSYM ID NIL T])
                                                                        [83]


(GETRADIX50
  [LAMBDA (S)
    (PROG (RADTMP [LEN (COND
                         ((ILESSP 6 (NCHARS S))
                           6)
                         ((NCHARS S]
                  (RAD 0)
                  (TS (SUBSTRING S 1 -1)))
          [RPTQ LEN (PROGN (SETQ RADTMP (CHCON1 (GNC TS)))
                           (COND
                             ((AND (IGREATERP RADTMP 57Q)
                                   (ILESSP RADTMP 72Q))
                              (SETQ RADTMP (IDIFFERENCE RADTMP 57Q)))
                             ((AND (IGREATERP RADTMP 100Q)
                                   (ILESSP RADTMP 133Q))
                              (SETQ RADTMP (IDIFFERENCE RADTMP 66Q)))
                             ((AND (IGREATERP RADTMP 140Q)
                                   (ILESSP RADTMP 173Q))
                              (SETQ RADTMP (IDIFFERENCE RADTMP 126Q)))
                             ((EQ RADTMP 56Q)
                              (SETQ RADTMP (IDIFFERENCE RADTMP 11Q)))
```

```
                              ((OR (EQ RADTMP 44Q)
                                   (EQ RADTMP 45Q))
                                (SETQ RADTMP (IPLUS RADTMP 2)))
                               (T (RETURN 0)))
                             (SETQ RAD (IPLUS (ITIMES RAD 50Q)
                                              RADTMP]
          (RETURN RAD])
```

[84]

```
(FKTIME
  [LAMBDA (FKEXPR)
    (PROG (FKRESULT FKLISPTIME FKFORKTIME FKHNDL)
          (AND FORKDATA (FKJSYS 15Q (SETQ FKHNDL (FKHNDL FORKDATA)))
               (SETQ FKFORKTIME FKJSYSAC1))
          (FKJSYS 15Q 400000Q)
          (SETQ FKLISPTIME FKJSYSAC1)
          (SETQ FKRESULT (EVAL FKEXPR))
          (FKJSYS 15Q 400000Q)
          (SETQ FKLISPTIME (FQUOTIENT (IDIFFERENCE FKJSYSAC1 FKLISPTIME)
                                      FKJSYSAC2))
          (AND FKFORKTIME (FKJSYS 15Q FKHNDL)
               (SETQ FKFORKTIME (FQUOTIENT (IDIFFERENCE FKJSYSAC1
                                                        FKFORKTIME)
                                           FKJSYSAC2)))
          (RETURN (LIST FKRESULT (FPLUS FKLISPTIME FKFORKTIME)
                        FKLISPTIME FKFORKTIME])
```

[85]

```
(FKJSYS
  [LAMBDA (FKJSYSNO ARG1 ARG2 ARG3 ARG4 ARG5)    (* NOBIND
                                                  "29-Nov-78 17:38")
    (ASSEMBLE NIL
              (CQ (VAG FKJSYSNO))
              (HRRM 1 , FKJSYS)
              (MOVEI 1 , 4)
              (MOVEM 1 , RETCNT)
              (CQ (FKJSYSARG ARG2))
              (MOVEM 1 , AC2)
              (CQ (FKJSYSARG ARG3))
              (MOVEM 1 , AC3)
              (CQ (FKJSYSARG ARG4))
              (MOVEM 1 , AC4)
              (CQ (FKJSYSARG ARG5))
              (MOVEM 1 , AC5)
              (CQ (FKJSYSARG ARG1))
              (MOVE 2 , AC2)
              (MOVE 3 , AC3)
              (MOVE 4 , AC4)
              (MOVE 5 , AC5)
            FKJSYS
              (JSYS 0)
              (SOS RETCNT)
              (SOS RETCNT)
              (SOS RETCNT)
              (MOVEM 2 , AC2)
              (MOVEM 3 , AC3)
```

```
            [CQ (SETQ FKJSYSAC1 (LOC (AC]
            (MOVE 1 , AC2)
            [CQ (SETQ FKJSYSAC2 (LOC (AC]
            (MOVE 1 , AC3)
            [CQ (SETQ FKJSYSAC3 (LOC (AC]
            (MOVE 1 , RETCNT)
            (FASTCALL MKN)
            (JRST RETURN)
          RETCNT
            (0)
          AC2 (0)
          AC3 (0)
          AC4 (0)
          AC5 (0)
          RETURN])
```

[86]

```
(FKJSYSARG
  [LAMBDA (X)                                          (* NOBIND
                                                       "29-Nov-78 17:44")
    (PROG (ARG S)
      A   [SETQ ARG (COND
            ((NULL X)
              0)
            ((STRINGP X)
              [SETQ FKJSYSTR (COND
                  ((ZEROP (CHCON1 (NTHCHAR X -1)))
                    X)
                  (T (CONCAT X (CHARACTER 0]
              (SETQ S (IPLUS (LOC (CAR FKJSYSTR))
                             (LSH (LOGAND (LOC (CDR FKJSYSTR))
                                          7)
                                  18)))
              (LOGOR (IQUOTIENT S 5)
                     117440512
                     (LLSH (IDIFFERENCE 36 (ITIMES (IREMAINDER S 5)
                                                   7))
                           30)))
            ((ARRAYP X)
              (IPLUS 2 (LOC X)))
            ((NUMBERP X)
              X)
            (T (SETQ X (ERROR X "FKJSYS ARGUMENT ERROR"))
               (GO A]
          (RETURN (VAG ARG])
```

[87]

```
(FKWAIT
  [LAMBDA (FKHNDL)                                     (* NOBIND
                                                       "24-Nov-78 16:42")
    (PROG NIL
      WAIT(FKJSYS 156Q FKHNDL)                         (* RFSTS)
          (SETQ FKSTATUS (LRSH FKJSYSAC1 22Q))
          (COND
            ((EQ FKSTATUS 2))
```

```
            ((EQ FKSTATUS 1)
              (FKJSYS 206Q FKHNDL)                    (* GPJFN)
              (FKJSYS 104Q (LOGAND FKJSYSAC2 777777Q))
                                                      (* DOBE)
              (FKJSYS 162Q FKHNDL)                    (* HFORK)
              (DISMISS 12Q))
            ((MEMB FKSTATUS (QUOTE (0 4 5)))
              (DISMISS 764Q)
              (GO WAIT))
            (T (HELP "UNUSUAL FORK STATUS:" FKSTATUS])
)

(ADDTOVAR GLOBALVARS FORKDATA DSPNOWAITFLG)

(ADDTOVAR AFTERSYSOUTFORMS (PROGN (RPLACA FORKDATA NIL)
                                  (FKKILL)))
(AND (EQ (EVALV (QUOTE FORKDATA))
         (QUOTE NOBIND))
     (SETQ FORKDATA NIL))

(PUTPROPS FKIDPB MACRO [(E P)
                        (ASSEMBLE NIL
                                  (CQ (VAG E))
                                  (PUSHN 1)
                                  (CQ P)
                                  (POPN 2)
                                  (IDPB 2 , 0 (1])

(PUTPROPS FKRACS MACRO ((FKHNDL A)
                        (ASSEMBLE NIL
                                  (CQ (VAG (IPLUS (LOC A)
                                                  2)))
                                  (PUSHN 1)
                                  (CQ (VAG FKHNDL))
                                  (POPN 2)
                                  (JSYS 161Q))
                                                  (* RFACS)
                        ))

(PUTPROPS FKSACS MACRO ((FKHNDL A)
                        (ASSEMBLE NIL
                                  (CQ (VAG (IPLUS (LOC A)
                                                  2)))
                                  (PUSHN 1)
                                  (CQ (VAG FKHNDL))
                                  (POPN 2)
                                  (JSYS 160Q))
                                                  (* SFACS)
                        ))

(PUTPROPS PUTTYP MACRO [(N)
                        (ASSEMBLE NIL
                                  (CQ FKCBP)
                                  (HRRZI 2 , N)
                                  (IDPB 2 , 0 (1])

(PUTPROPS FKHNDL MACRO ((X)
```

```
                          (CAR X)))

(PUTPROPS FKHT MACRO ((X)
                      (CAADR X)))

(PUTPROPS FKSHR MACRO ((X)
                       (CADDDR X)))

(PUTPROPS FKSYMACS MACRO ((X)
                          (CADR (CDDDR X))))

(PUTPROPS FKDDT MACRO ((X)
                       (CADR (CDDDDR X))))

(PUTPROPS FKJFN MACRO ((X)
                       (CADDR (CDDDDR X))))

(PUTPROPS FKHT_ MACRO ((X Y)
                       (RPLACA (CADR X)
                               Y)))

(PUTPROPS FKDDT_ MACRO ((X Y)
                        (RPLACA (CDDR (CDDDR X))
                                Y)))

(PUTPROPS FKPROG MACRO ((X)
                        (CADDDR (CDDDDR X))))

(PUTPROPS FKHALT MACRO ((X)
                        (CADADR X)))

(RPAQQ FORKBLOCKS ((FKCALLBLOCK FKCALL FKCATYPE FKSR SAILCALL SAILARG
                                SAILSTRING FKACS FKACSRETURN FKRTN
                                (NOLINKFNS . T)
                                (ENTRIES FKCALL SAILCALL FKCATYPE FKACS
                                         FKACSRETURN))
        (FKARRAYBLOCK FKARRAY FKCORGET FKELT FKELTI FKELTR FKSETA
                      FKARRAYP FKBCHECK FKARRADR FKFLOAT (NOLINKFNS . T)
                      (ENTRIES FKARRAY FKELT FKELTI FKELTR FKSETA
                               FKARRAYP FKFLOAT))
        (FKSYMBLOCK FKSYM FKSYMP FKSYMPUT GETRADIX50 (NOLINKFNS . T)
                    (ENTRIES FKSYM FKSYMP FKSYMPUT))
        (FKJSYSBLOCK FKJSYS FKJSYSARG (NOLINKFNS . T)
                     (ENTRIES FKJSYS))))
[DECLARE: DONTEVAL@LOAD DOEVAL@COMPILE DONTCOPY
(BLOCK: FKCALLBLOCK FKCALL FKCATYPE FKSR SAILCALL SAILARG SAILSTRING
        FKACS FKACSRETURN FKRTN (NOLINKFNS . T)
        (ENTRIES FKCALL SAILCALL FKCATYPE FKACS FKACSRETURN))
(BLOCK: FKARRAYBLOCK FKARRAY FKCORGET FKELT FKELTI FKELTR FKSETA
        FKARRAYP FKBCHECK FKARRADR FKFLOAT (NOLINKFNS . T)
        (ENTRIES FKARRAY FKELT FKELTI FKELTR FKSETA FKARRAYP FKFLOAT))
(BLOCK: FKSYMBLOCK FKSYM FKSYMP FKSYMPUT GETRADIX50 (NOLINKFNS . T)
        (ENTRIES FKSYM FKSYMP FKSYMPUT))
(BLOCK: FKJSYSBLOCK FKJSYS FKJSYSARG (NOLINKFNS . T)
        (ENTRIES FKJSYS))
]
(DECLARE: DONTEVAL@LOAD DOEVAL@COMPILE DONTCOPY COMPILERVARS
```

```
(ADDTOVAR NLAMA SAILCALL FKCALL)

(ADDTOVAR NLAML FKSETVAL FKVALI FKVALR FKVAL FKSETA FKELTR FKELTI FKELT
                        FKARRAY FKX FKINIT)
)
(DECLARE: DONTCOPY
  (FILEMAP (NIL (1295 37331 (FKINIT 1307 . 5060) (FKKILL 5064 . 5982) (
FKSAVE 5986 . 6375) (FKDDT 6379 . 7661) (FKCALL 7665 . 11545) (FKCATYPE
11549 . 11870) (FKSR 11874 . 12612) (SAILCALL 12616 . 15106) (SAILARG
15110 . 18208) (SAILSTRING 18212 . 18853) (FKACS 18857 . 19041) (
FKACSRETURN 19045 . 19159) (FKRTN 19163 . 19479) (NOFORK 19483 . 19606)
(FKCALLERR 19610 . 19701) (FKSW 19705 . 20590) (FKX 20594 . 20686) (
FKTTYSET 20690 . 21667) (FKARRAY 21671 . 24128) (FKCORGET 24132 . 24466)
 (FKELT 24470 . 24708) (FKELTI 24712 . 25073) (FKELTR 25077 . 25443) (
FKSETA 25447 . 25851) (FKARRAYP 25855 . 26061) (FKARRAYSIZE 26065 .
26135) (SAILARRAYSIZE 26139 . 26444) (FKARRAYTYPE 26448 . 26722) (
FKBCHECK 26726 . 26845) (FKARRADR 26849 . 28129) (FKFLOAT 28133 . 28250)
 (ARRLOC 28254 . 28406) (FKVAL 28410 . 28571) (FKVALR 28575 . 28689) (
FKVALI 28693 . 30236) (FKSETVAL 30240 . 31842) (FKSYM 31846 . 32550) (
FKSYMPUT 32554 . 32763) (FKSYMP 32767 . 32813) (GETRADIX50 32817 . 33686
) (FKTIME 33690 . 34359) (FKJSYS 34363 . 35888) (FKJSYSARG 35892 . 36645
) (FKWAIT 36649 . 37328)))))
STOP
```

```
(FILECREATED " 7-Aug-79 19:03:11" <RBECHTAL>HASHER..38 8393

     changes to:  GETSH

     previous date: " 6-Aug-79 14:37:00" <RBECHTAL>HASHER..37)


(PRETTYCOMPRINT HASHERCOMS)

(RPAQQ HASHERCOMS ((VARS * HASHERVARS)
                   (FNS * HASHERFNS)))

(RPAQQ HASHERVARS (MEMORY MEMSIZE MEMLIMIT MEMFACTOR))

(RPAQQ MEMORY NIL)

(RPAQQ MEMSIZE 256)

(RPAQQ MEMLIMIT 0)

(RPAQQ MEMFACTOR 0)

(RPAQQ HASHERFNS (ADDH CREATH FASTHAK GETH GETSH GETSTRIP LOCH MAPH
                       MEMDENSITY MEMTEST NEWHASH NEXTH PREHASH PUTH
                       PUTSH))
(DEFINEQ

                                                                    [88]

(ADDH
  [LAMBDA (ARGS NEWVAL)                                 (* edited:
                                                        " 6-Aug-79 13:51")

          (* ADDH is really no longer necessary -
          PUTSH does the same job now.)

    (PUTSH ARGS NEWVAL])

                                                                    [89]

(CREATH
  [LAMBDA (SIZE)                                        (* edited:
                                                        " 6-Aug-79 13:58")

          (* CREATH creates an array, called MEMORY, of the
          size specified by the argument given to CREATH.
          This array will be treated as a hash array, and is
          used to store the assertion retrieval information.)

    (SETQ MEMORY (ARRAY SIZE))
    (SETQ MEMSIZE SIZE)
    (SETQ MEMFACTOR (ADD1 (IQUOTIENT (LOG SIZE)
                                     5)))
    (SETQ MEMFILLED 0)
```

```
    (SETQ MEMFULLSIZE (IQUOTIENT (ITIMES SIZE 4)
                                 5])
                                                                    [90]

(FASTHAK
  [LAMBDA NIL                                    (* edited:
                                                 " 6-Aug-79 13:59")
                                                 (* FASTHAK provides a
                                                 way to look at the
                                                 contents of MEMORY.)
    (MAPH MEMORY MEMSIZE (FUNCTION MEMTEST])
                                                                    [91]

(GETH
  [LAMBDA (ARGS)                                 (* edited:
                                                 " 6-Aug-79 14:01")

          (* GETH retrieves the CDR of the element of the
          array whose CAR contains ARGS.)

    (ELTD MEMORY (LOCH ARGS])
                                                                    [92]

(GETSH
  [LAMBDA (ARGS)                                 (* edited:
                                                 " 7-Aug-79 19:03")

          (* GETSH is insured to return a stream.
          It's not unlike GETH, but will create
          (and store) a stream if necessary.)

                                                 (* The APPEND is
                                                 necessary because
                                                 RETSTREAM reuses a
                                                 scratchlist)
    (OR (GETH ARGS)
        (PUTH (APPEND ARGS)
              (NEWSTREAM])
                                                                    [93]

(GETSTRIP
  [LAMBDA (ARGS)                                 (* edited:
                                                 " 6-Aug-79 14:04")
                                                 (* GETSTRIP returns a
                                                 list of assertions which
                                                 match ARGS.)
    (STRIPSTREAM (GETH ARGS])
```

[94]

```
(LOCH
  [LAMBDA (ARGS PUTFLG)                                  (* edited:
                                                         " 6-Aug-79 14:08")

          (* LOCH generates a location in MEMORY whose CAR is
          ARGS. This may involve moving down in the case of
          collisions. PUTFLG signals that the indexing is for
          insertion (so that erased locations can be reused).)


    (PROG (LOC CONT)
          (SETQ LOC (PREHASH ARGS))
          (SETQ MEMTESTCNT 1)
      GLOOP
          (SETQ CONT (ELT MEMORY LOC))
          (COND
            ([OR (EQUAL CONT ARGS)
                 (NULL CONT)
                 (AND PUTFLG (EQ CONT (QUOTE *erased*]
              (RETURN LOC))
            (T (SETQ LOC (NEXTH LOC ARGS))
               (SETQ MEMTESTCNT (ADD1 MEMTESTCNT))
               (GO GLOOP])
```

[95]

```
(MAPH
  [LAMBDA (ARY ARYSZ ARYFN)                              (* edited:
                                                         " 6-Aug-79 14:09")

          (* MAPH maps ARYFN, a function of two arguments,
          over the array ARY, which has size ARYSZ.
          Used by MEMTEST and NEWHASH.)


    (PROG ((COUNT 1)
           CONTENT)
      MPLOOP
          (COND
            ((GREATERP COUNT ARYSZ)
              (RETURN)))
          [COND
            ((ELT ARY COUNT)
              (APPLY* ARYFN (ELT ARY COUNT)
                      (ELTD ARY COUNT]
          (SETQ COUNT (ADD1 COUNT))
          (GO MPLOOP])
```

[96]

```
(MEMDENSITY
  [LAMBDA NIL                                            (* edited:
                                                         " 6-Aug-79 14:22")
                                                         (* MEMDENSITY calculates
                                                         how full MEMORY is.)
```

```
    (PRIN1 "memory is ")
    (PRIN1 (FTIMES 100.0 (FQUOTIENT MEMFILLED MEMSIZE)))
    (PRIN1 " percent full.")
    (TERPRI)
    (PRIN1 MEMFILLED)
    (PRIN1 " out of ")
    (PRIN1 MEMSIZE)
    (PRIN1 " spaces are in use.")
    (TERPRI])
```

[97]

```
(MEMTEST
  [LAMBDA (X Y)                                    (* edited:
                                                   " 6-Aug-79 14:29")

          (* MEMTEST prints useful information about the
          contents of MEMORY. However, if there's a lot in
          memory, it gets very dull.)


    (COND
      ((NULL X))
      (T (PRIN1 COUNT)
         (PRIN1 "  ")
         (PRIN1 X)
         (PRIN1 "  ")
         (PRIN1 (CAAR Y))
         (PRIN1 "  ")
         (PRIN1 (LENGTH (CADR Y)))
         (TERPRI])
```

[98]

```
(NEWHASH
  [LAMBDA NIL                                      (* edited:
                                                   " 6-Aug-79 14:30")
                                                   (* NEWHASH creates a new
                                                   hash array. Effectively
                                                   a dynamic expansion of
                                                   MEMORY.)
    (PROG ((A MEMORY)
           (OLDSIZE MEMSIZE))
          (CREATH (PLUS MEMSIZE (IQUOTIENT MEMSIZE 2)))
          (MAPH A OLDSIZE (FUNCTION (LAMBDA (LEFT RIGHT)
                    (COND
                      [(OR (NULL LEFT)
                           (EQ LEFT (QUOTE *erased*]
                      (T (PUTH LEFT RIGHT])
```

[99]

```
(NEXTH
  [LAMBDA (LOC ARG)                                (* edited:
                                                   " 6-Aug-79 14:32")

          (* NEXTH generates a new address in the case of
```

```
        collisions. It's a simple "move down", with the
        increment selected to be relatively prime to an
        reasonable array size (preventing wraparound), and
        widely spaced.)


    (PROG (NEWLOC)
          (SETQ NEWLOC (IDIFFERENCE LOC 659))
      NXTLP
          (COND
            ((GREATERP 1 NEWLOC)
              (SETQ NEWLOC (IPLUS MEMSIZE NEWLOC))
              (GO NXTLP))
            (T (RETURN NEWLOC])
```

[100]

```
(PREHASH
  [LAMBDA (L)                                    (* edited:
                                                 " 6-Aug-79 14:33")

        (* PREHASH generates an address given a retrieval
        spec. It is the primary hashing function.)


    (PROG (C N)
          (SETN PREHASHSUM 0)
      OUTER
          (SETN PREHASHSUM1 0)
          (SETQ N 3)
      INNER
          [COND
            ((NULL L)
              (RETURN (ADD1 (IREMAINDER (IPLUS PREHASHSUM PREHASHSUM1)
                                        MEMSIZE]
          (SETQ C (CAR L))
          (SETN PREHASHSUM1 (IPLUS (LSH PREHASHSUM1 8)
                                   (LOGAND (COND
                                             ((LITATOM C)
                                               (LOC C))
                                             ((NUMBERP C)
                                               (LOC (VAG C)))
                                             ((STRINGP C)
                                               (LOC (MKATOM C)))
                                             ((LISTP C)
                                               (PREHASH C))
                                             (T (HELP
                                                  "BAD ARG - PREHASH")))
                                           255)))
          (SETQ L (CDR L))
          (SETQ N (SUB1 N))
          (COND
            ((ZEROP N)
              (SETN PREHASHSUM (IPLUS PREHASHSUM PREHASHSUM1))
              (GO OUTER)))
          (GO INNER])
```

[101]

```
(PUTH
  [LAMBDA (ARGS AVAL)                                    (* edited:
                                                         " 6-Aug-79 14:34")
                                                         (* PUTH sticks things in
                                                         MEMORY, expanding if
                                                         necessary.)

    (COND
      ((IGREATERP MEMFILLED MEMFULLSIZE)
        (NEWHASH)))
    (SETQ MEMFILLED (ADD1 MEMFILLED))
    (PROG ((LOC (LOCH ARGS T)))
          (SETA MEMORY LOC ARGS)
          (SETD MEMORY LOC AVAL)
          (RETURN AVAL])
```

[102]

```
(PUTSH
  [LAMBDA (ARGS AVAL)                                    (* edited:
                                                         " 6-Aug-79 14:36")
                                                         (* PUTSH places AVAL in
                                                         the stream associated
                                                         with ARGS)

    (PUTSTREAM (GETSH ARGS)
               AVAL])
)
(DECLARE: DONTCOPY
  (FILEMAP (NIL (555 8369 (ADDH 567 . 852) (CREATH 856 . 1477) (FASTHAK
1481 . 1766) (GETH 1770 . 2069) (GETSH 2073 . 2548) (GETSTRIP 2552 .
2820) (LOCH 2824 . 3617) (MAPH 3621 . 4226) (MEMDENSITY 4230 . 4790) (
MEMTEST 4794 . 5326) (NEWHASH 5330 . 5859) (NEXTH 5863 . 6522) (PREHASH
6526 . 7616) (PUTH 7620 . 8085) (PUTSH 8089 . 8366)))))
STOP
```

```
(FILECREATED "28-Aug-79 21:06:16" <RBECHTAL>INTERP..37 12152


     changes to:  JUSTBUILD

     previous date: "27-Aug-79 21:31:58" <RBECHTAL>INTERP..36)


(PRETTYCOMPRINT INTERPCOMS)

(RPAQQ INTERPCOMS [(FNS * INTERPFNS)
                   (VARS (VDRELS (QUOTE (LESS-THAN SAME-AS GREATER-THAN]
)

(RPAQQ INTERPFNS (ANDHACK APPLYRULE CONSTRUCT GETPULSAR JUSTBUILD
                          MASSAGE1 NOTHACK ORACLEHACK ORBUILD ORHACK
                          SAVEPULSAR SWEEPER UNLESSHACK VAR?))
(DEFINEQ

                                                                  [103]

(ANDHACK
  [LAMBDA (CONDITIONS ACTIONS EV)                    (* edited:
                                                     " 7-Aug-79 10:12")

          (* ANDHACK handles anded conditions
          (those without special modifiers). An AND is true
          (succeeds) if the confidence in the assertion it
          finds is greater than .1 (an arbitrary threshold).
          Like all of the other hacks, ANDHACK relies on
          MAPRETRIEVE to do the real work.
          Oracles are evaluated first, so that their results
          will exist in the network for the MAPRETRIEVE to
          find.)


    (ORACLEHACK (CAR CONDITIONS))
    (MAPRETRIEVE (CAR CONDITIONS)
                 (LIST (CDR CONDITIONS)
                       ACTIONS EV)
                 (FUNCTION (LAMBDA (X P)
                     (PROG ((CLIST (CAR P))
                            (ACTIONS (CADR P))
                            (EV (CADDR P)))
                           (COND
                             ((GREATERP (GETCON X)
                                        .1)
                               (SWEEPER CLIST ACTIONS (CONS X EV))
                               (RETURN T])

                                                                  [104]

(APPLYRULE
  [LAMBDA (RULENAME PREBIND)                         (* edited:
                                                     "19-Jul-79 14:43")

          (* APPLYRULE is the function that starts all of the
```

```
          work of the rule interpreter.
          When APPLYRULE is called on a rule, it starts the
          process of mapping retrieval functions over the data
          base based on the conditions of the rule.
          Binding of variables is accomplished in this version
          by rewriting the remaining conditions with the
          bindings substituted for the variables.)


    (SWEEPER (SUBLIS PREBIND (GETPROP RULENAME (QUOTE CONDITIONS)))
             (SUBLIS PREBIND (GETPROP RULENAME (QUOTE ACTIONS)))
             (CONS RULENAME])
```

[105]

```
(CONSTRUCT
  [LAMBDA (ACTIONS EV COUNT)                          (* edited:
                                                      "27-Aug-79 11:47")
    (PROG (FIRST)

          (* CONSTRUCT is the function that steps through the
          actions of a rule and passes them to the appropriate
          conclusion building functions.)


          (OR COUNT (SETQ COUNT 1))
      CLOOP
          (COND
            ((NULL ACTIONS)
              (RETURN T))
            (T (SETQ FIRST (CAR ACTIONS))
               (COND
                 ((EQ (CAR FIRST)
                      (QUOTE *OR*))
                   (ORBUILD (CDR FIRST)
                            EV))
                 ((EQ (CAR FIRST)
                      (QUOTE *REPORT*))
                   (SETQ RESULTLIST (CONS (MASSAGE1 FIRST)
                                          RESULTLIST)))
                 (T (JUSTBUILD FIRST EV COUNT)))
               (SETQ ACTIONS (CDR ACTIONS))
               (GO CLOOP])
```

[106]

```
(GETPULSAR
  [LAMBDA (NODE)                                      (* edited:
                                                      " 7-Aug-79 10:14")


          (* GETPULSAR, as its name suggests, gets the pulsar
          (if any) associated with a node.
          Isolating this as a function allows redesign of
          pulsar storage with minimal rewriting.)


    (GETPROP NODE (QUOTE PULSAR])
```

[107]

```
(JUSTBUILD
  [LAMBDA (SPEC EV NUMBER)                          (* edited:
                                                    "28-Aug-79 21:06")
    (PROG (NEWNODE NEWFLG MASSAGESPEC)

          (* This is the function that actually builds
          conclusions in the assertion memory, or data base.
          Because of the immediacy of the stream coroutines,
          it is necessary to build the derivation tree before
          actually adding the new assertion to the memory,
          lest the new assertion be used for some rule without
          having its confidence calculable.)


          (SETQ MASSAGESPEC (MASSAGE1 SPEC))
          [SETQ NEWNODE (COND
              ((CAR (GETSTRIP MASSAGESPEC)))
              (T (SETQ NEWFLG (GENSYM]
          (SETQ RESULTLIST (CONS NEWNODE RESULTLIST))
          [PUTPROP NEWNODE (QUOTE DERIVE*)
                   (CONS (REVERSE EV)
                         (GETPROP NEWNODE (QUOTE DERIVE*]
          [COND
            (NEWFLG (SET NEWNODE MASSAGESPEC)
                    (SETQ ASSERTIONS (CONS NEWNODE ASSERTIONS))
                    (SAVEPULSAR NEWNODE)
                    (SERT (MASSAGE1 SPEC)
                          NEWNODE))
            (T (PULSE (GETPULSAR NEWNODE]
          (RETURN NEWFLG])
```

[108]

```
(MASSAGE1
  [LAMBDA (SPECLIST)                                (* edited:
                                                    " 7-Aug-79 10:17")

          (* MASSAGE1 takes a condition
          (or action) and binds its variables to their
          interpreter values. GETMRVAL
          (called by MASSAGE1) has since been extended to deal
          with lists as well as atoms, so that calls to
          MASSAGE1 could be directly replaced with calls to
          GETMRVAL.)


    (MAPCAR SPECLIST (FUNCTION (LAMBDA (X)
                (COND
                  ((VAR? X)
                    (GETMRVAL X))
                  (T X])
```

[109]

```
(NOTHACK
  [LAMBDA (CONDITIONS ACTIONS EV)                    (* edited:
                                                     " 7-Aug-79 10:18")

          (* NOTHACK requires a confidence less than -.1 to
          continue the rule evaluation.
          General comments about the connective hacks apply.)


     (ORACLEHACK (CADAR CONDITIONS))
     (MAPRETRIEVE (CADAR CONDITIONS)
                  (LIST (CDR CONDITIONS)
                        ACTIONS EV)
                  (FUNCTION (LAMBDA (X P)
                      (PROG ((CLIST (CAR P))
                             (ACTIONS (CADR P))
                             (EV (CADDR P)))
                            (COND
                              ((LESSP (GETCON X)
                                      -.1)
                                (SWEEPER CLIST ACTIONS
                                         (CONS (LIST (QUOTE NOT)
                                                     X)
                                               EV))
                                (RETURN T])
```

[110]

```
(ORACLEHACK
  [LAMBDA (SPEC)                                     (* edited:
                                                     " 7-Aug-79 10:21")

          (* ORACLEHACK deals with oracular conditions.
          Firsts, it tests for the presence of an oracle.
          If one is found, it then checks the data base to see
          if it has already been computed.
          If not, it computes the oracle, and places the
          result in the memory, where it can be used by the
          normal condition evaluation procedure.
          Computation is restricted to oracles with LASTARG on
          their property list under the property name ORTYPE.
          Such oracles bind their last argument.)


     (PROG (PTR LAST-ARG LASTCONS ANS ORTYPE)
           (COND
             ((GETPROP (CAR SPEC)
                       (QUOTE ORACLE))
               (SETQ SPEC (GETMRVAL SPEC T))
               (SETQ ORTYPE (GETPROP (CAR SPEC)
                                     (QUOTE ORTYPE)))
               (SELECTQ ORTYPE
                        [LASTARG (SETQ LASTCONS (LAST SPEC))
                                 (SETQ PTR (NLEFT SPEC 2))
                                 (SETQ LAST-ARG (CADR PTR))
```

```
                                (RPLACD PTR NIL)
                                (SETQ ANS (APPLY (CAR SPEC)
                                                 (CDR SPEC)))
                                (COND
                                  ((OR (VAR? LAST-ARG)
                                       (EQUAL LAST-ARG ANS))
                                    (NCONC PTR (RPLACA LASTCONS ANS))
                                    (CASSERT SPEC 1.0]
                          (COND
                            ((APPLY (CAR SPEC)
                                    (CDR SPEC))
                              (CASSERT SPEC 1.0))
                            (T (CASSERT SPEC -1.0])
```

[111]

```
(ORBUILD
  [LAMBDA (SPEC EV)                                    (* edited:
                                                       "27-Aug-79 11:49")
    (PROG (COUNT)

          (* ORBUILD constructs disjunctive conclusions by
          repeated calls to JUSTBUILD.
          At present, no provision is made to divide
          confidences among the ORed conclusions.)


          (SETQ COUNT (LENGTH SPEC))
      OLOOP
          (COND
            ((NULL SPEC)
              (RETURN))
            (T (CONSTRUCT (CAR SPEC)
                          EV COUNT)
               (SETQ SPEC (CDR SPEC))
               (GO OLOOP])
```

[112]

```
(ORHACK
  [LAMBDA (CONDITIONS ACTIONS EV)                      (* edited:
                                                       "19-Jul-79 19:21")

          (* This handles disjuctive conditions by re-writing
          them as multiple rules. There is probably a problem
          with the handling of the confidence here, as no
          effort is made to correct the confidence for the
          split.)


    (for TEMP2 in (CDAR CONDITIONS) do (SWEEPER (CONS (CAR TEMP2)
                                                      (CDR CONDITIONS))
                                                ACTIONS EV])
```

[113]

```
(SAVEPULSAR
  [LAMBDA (NODE)                                    (* edited:
                                                    " 7-Aug-79 10:25")

          (* SAVEPULSAR saves a pulsar on a node.
          If the method of storing pulsars should change, the
          modularity of SAVEPULSAR and GETPULSAR insure that
          they are the only functions that need to be changed,
          since all pulsar access is done through them.)


    (PUTPROP NODE (QUOTE PULSAR)
             (PULSAR])
```

[114]

```
(SWEEPER
  [LAMBDA (CONDITIONS ACTIONS EV)                   (* edited:
                                                    "27-Aug-79 21:31")
    (PROG (THISCOND C)

          (* SWEEPER, which is where the work used to get
          done, now is merely a big switch which determines
          the appropriate condition handling function to call.
          The functions generated by these condition handlers
          and FUNCTIONWRITER will then call SWEEPER
          recursively.)


          [COND
            ((NULL CONDITIONS)
              (RETURN (CONSTRUCT ACTIONS EV)))
            (T (SETQ THISCOND (CAAR CONDITIONS]
          (COND
            ((MEMB THISCOND VDRELS)
              (AND (APPLY THISCOND (GETMRVAL (CDAR CONDITIONS)))
                   (SWEEPER (CDR CONDITIONS)
                            ACTIONS EV)))
            ((EQ THISCOND (QUOTE *OR*))
              (ORHACK CONDITIONS ACTIONS EV))
            [(EQ THISCOND (QUOTE *NOT*))
              (SETQ C (CADAR CONDITIONS))
              (COND
                ((MEMB (CAR C)
                       VDRELS)
                  (OR (APPLY (CAR C)
                             (GETMRVAL (CDR C)))
                      (SWEEPER (CDR CONDITIONS)
                               ACTIONS EV)))
                (T (NOTHACK CONDITIONS ACTIONS EV]
            ((EQ THISCOND (QUOTE *UNLESS*))
              (UNLESSHACK CONDITIONS ACTIONS EV))
            (T (ANDHACK CONDITIONS ACTIONS EV])
```

[115]

```
(UNLESSHACK
  [LAMBDA (CONDITIONS ACTIONS EV)                    (* edited:
                                                     " 7-Aug-79 10:30")

          (* UNLESSHACK is the connective hack that deals with
          UNLESS conditions. While the general comments about
          hacks apply to UNLESSHACK, it is quite different in
          that it expects to find its assertion in the memory,
          adding it (with confidence 0.0) if necessary.
          Since UNLESSes succeed if the confidence in their
          assertion is 0.0 or less, adding an assertion to
          memory in UNLESS forces the condition to succeed.
          UNLESSes are only blocked if information
          (with positive confidence) already exists in the
          network. Given the parallel rule application, this
          feature can create problems unless care is taken in
          rule construction. This problem will be discussed
          further in later working papers.)


    (ORACLEHACK (CADAR CONDITIONS))
    (COND
      [(STRIPSTREAM (RETSTREAM (CADAR CONDITIONS]
      (T (CASSERT (MASSAGE1 (CADAR CONDITIONS))
                  0.0)))
    (MAPRETRIEVE (CADAR CONDITIONS)
                 (LIST (CDR CONDITIONS)
                       ACTIONS EV)
                 (FUNCTION (LAMBDA (X P)
                     (PROG ((CLIST (CAR P))
                            (ACTIONS (CADR P))
                            (EV (CADDR P)))
                           (COND
                             ((LEQ (GETCON X)
                                   0.0)
                               (SWEEPER CLIST ACTIONS
                                        (CONS (LIST (QUOTE UNLESS)
                                                    X)
                                              EV))
                               (RETURN T])
```

[116]

```
(VAR?
  [LAMBDA (Q)                                        (* edited:
                                                     "11-May-79 0[illegible].46")

          (* VAR? tests to see if an atom is in variable
          format. Variables start with an asterisk.)


    (EQ (CHCON1 Q)
        42])
)
```

```
(RPAQQ VDRELS (LESS-THAN SAME-AS GREATER-THAN))
(DECLARE: DONTCOPY
  (FILEMAP (NIL (462 12077 (ANDHACK 474 . 1502) (APPLYRULE 1506 . 2184) (
CONSTRUCT 2188 . 2953) (GETPULSAR 2957 . 3386) (JUSTBUILD 3390 . 4509) (
MASSAGE1 4513 . 5148) (NOTHACK 5152 . 5903) (ORACLEHACK 5907 . 7358) (
ORBUILD 7362 . 7898) (ORHACK 7902 . 8464) (SAVEPULSAR 8468 . 8995) (
SWEEPER 8999 . 10184) (UNLESSHACK 10188 . 11766) (VAR? 11770 . 12074))))
)
STOP
```

```
(FILECREATED " 6-Aug-79 17:32:02" <RBECHTAL>MANIPULATE..20 8876


     changes to:  ASSERT BUMP CASSERT DENY GETUPLE MATCHER MAYBE
RETRIEVER RETVARS SERT STATE

     previous date: "19-Jul-79 15:45:55" <RBECHTAL>MANIPULATE..19)


(PRETTYCOMPRINT MANIPULATECOMS)

(RPAQQ MANIPULATECOMS [(FNS * MANIPULATEFNS)
                      (DECLARE: DONTEVAL@LOAD DOEVAL@COMPILE DONTCOPY
                                COMPILERVARS
                                (ADDVARS (NLAMA STATE MAYBE DENY)
                                         (NLAML)
                                         (LAMA])

(RPAQQ MANIPULATEFNS (ASSERT BUMP CASSERT DENY GETUPLE MATCHER MAYBE
                             RETRIEVER RETVARS SERT STATE))
(DEFINEQ

                                                                [117]

(ASSERT
  [LAMBDA (ARGLIST NODENAME)                          (* edited:
                                                      " 6-Aug-79 17:03")

          (* ASSERT creates an assertion and places it in
          memory, keyed by the appropriate retrieval
          specifications. ASSERT makes no statement regarding
          the confidence in the assertion, and thus should be
          used with the greatest caution, to avoid fouling
          rules. ASSERT takes one argument, a list, which it
          evaluates.)


    (PROG (REPLY LEN A)
          [COND
            ((GETSTRIP ARGLIST)
              (RETURN (CAR (GETSTRIP ARGLIST]
          [SETQ REPLY (COND
              (NODENAME)
              (T (GENSYM]
          (SETQ ASSERTIONS (CONS REPLY ASSERTIONS))
          (SET REPLY ARGLIST)
          (SAVEPULSAR REPLY)
          (SERT ARGLIST REPLY)
          (RETURN REPLY])

                                                                [118]

(BUMP
  [LAMBDA (L)                                         (* edited:
                                                      " 6-Aug-79 17:04")

          (* BUMP counts in binary, using a list of Ts and
```

```
        NILs in place of 1s and 0s. Given a list of Ts and
        NILs, returns a list of Ts and NILs that is "plus one"
        of its argument.)


    (PROG (ANS)
      BLOOP1
          [COND
            ((NULL L)
              (RETURN (DREVERSE ANS)))
            ((CAR L)
              (SETQ ANS (CONS NIL ANS))
              (SETQ L (CDR L))
              (GO BLOOP1))
            (T (SETQ ANS (CONS T ANS))
               (SETQ L (CDR L]
      BLOOP2
          (COND
            ((NULL L)
              (RETURN (DREVERSE ANS)))
            (T (SETQ ANS (CONS (CAR L)
                               ANS))
               (SETQ L (CDR L))
               (GO BLOOP2]))
```

[119]

```
(CASSERT
  [LAMBDA (SPEC VAL)                                    (* edited:
                                                        " 6-Aug-79 17:08")


        (* CASSERT works like ASSERT, only it establishes a
        confidence in the assertion it creates.
        CASSERT takes two arguments.
        The first is taken to be the assertion spec, and the
        second the confidence in the assertion.
        If the confidence argument is positive, it is used
        as the measure of belief in the assertion, and if
        negative, it is used as the measure of disbelief.
        Whichever measure is not specified is set to zero.)


    (PROG (NEWNODE)
          [COND
            ((GETSTRIP SPEC)
              (RETURN (CAR (GETSTRIP SPEC]
          (SETQ NEWNODE (GENSYM))
          (SETQ ASSERTIONS (CONS NEWNODE ASSERTIONS))
          [COND
            ((GREATERP VAL 0.0)
              (PUTPROP NEWNODE 'QUOTE MB)
                       VAL)
              (PUTPROP NEWNODE (QUOTE MD)
                       0.0))
            (T (PUTPROP NEWNODE (QUOTE MB)
                        0.0)
               (PUTPROP NEWNODE (QUOTE MD)
```

```
                    (ABS VAL]
          (SET NEWNODE SPEC)
          (SAVEPULSAR NEWNODE)
          (SERT SPEC NEWNODE)
          (RETURN NEWNODE])
```

[120]

```
(DENY
  [NLAMBDA L                                          (* edited:
                                                      " 6-Aug-79 17:10")

          (* DENY asserts its argument
          (s) (unevaluated) with confidence -1.0.
          The most common anticipated use of this function is
          at top level (LISP) in APPLY format, e.g. STATE
          (PLATFORM CONTACT34).)

    (CASSERT L -1.0])
```

[121]

```
(GETUPLE
  [LAMBDA (ASSER)                                     (* edited:
                                                      " 6-Aug-79 17:11")

          (* Given an assertion node, GETUPLE returns the
          tuple (content) of that node.)

    (EVAL ASSER])
```

[122]

```
(MATCHER
  [LAMBDA (L1 L2)                                     (* edited:
                                                      " 6-Aug-79 17:17")

          (* MATCHER is used by SERT to construct retrieval
          specifications from assertion tuples.
          MATCHER takes two arguments, an assertion tuple and
          a "binary number" list, such as that returned from
          BUMP. Wherever the "binary
number" list contains T, the corresponding element of the
          assertion tuple is used in the retrieval
          specification. Where the BNlist contains NIL, a * is
          inserted in the retrieval specification.
          The retrieval specification is returned.)

    (PROG (ANS)
      MLOOP
          [COND
            ((NULL L1)
              (RETURN (DREVERSE ANS)))
            ((CAR L1)
```

```
            (SETQ ANS (CONS (CAR L2)
                            ANS)))
          (T (SETQ ANS (CONS (QUOTE *)
                             ANS]
        (SETQ L1 (CDR L1))
        (SETQ L2 (CDR L2))
        (GO MLOOP])
```

[123]

```
(MAYBE
  [NLAMBDA L                                    (* edited:
                                                " 6-Aug-79 17:17")
                                                (* MAYBE functions like
                                                DENY, only gives a
                                                confidence of 0.0.)

    (CASSERT L 0.0])
```

[124]

```
(RETRIEVER
  [LAMBDA (SPEC)                                (* edited:
                                                " 6-Aug-79 17:29")

        (* RETRIEVER is the workhorse function that gets
        stuff out of the memory. RETRIEVER takes a single
        argument list (evaluated), which should be either an
        assertion tuple, or an assertion tuple with
        variables in some places. (A variable is an atom
        that starts with a star, such as *PLAT.) RETRIEVER
        returns a list of answers, each of the form
        (assertionnodematched alist), where the alist is a
        set of CONSES of the variables together with the
        ground instances which they matched.
        For example, (RETRIEVER (QUOTE
        (SIGHTING *PLAT *SNODE))) might return
        ((A0034 (*PLAT . CONNOLE) (*SNODE . SIGHTING1))
        (A0765 (*PLAT . MINSK) (*SNODE . SIGHTING55))))

    (PROG (RES)
          [MAPC (GETSTRIP (RETVARS SPEC))
                (FUNCTION (LAMBDA (W)
                    (PROG (RES1)
                          [MAP2C SPEC (GETUPLE W)
                                 (FUNCTION (LAMBDA (A B)
                                     (COND
                                       ((VAR? A)
                                         (SETQ RES1
                                           (CONS (CONS A B)
                                                 RES1]
                          (SETQ RES (CONS (CONS W RES1)
                                          RES]
          (RETURN RES])
```

[125]

```
(RETVARS
  [LAMBDA (SPEC)                                    (* edited:
                                                    " 6-Aug-79 17:30")
                                                    (* RETVARS massages
                                                    RETRIEVER specs to turn
                                                    them into retrieval
                                                    specifications.)
    (MAPCAR SPEC (FUNCTION (LAMBDA (ITEM)
                   (COND
                     ((VAR? ITEM)
                       (QUOTE *))
                     (T ITEM])
```

[126]

```
(SERT
  [LAMBDA (SPEC NODENAME)                           (* edited:
                                                    " 6-Aug-79 16:28")
    (PROG (LEN A)

          (* SERT is the function that actually stores the
          assertion nodes in the memory under specifications
          generated by MATCHER with the help of BUMP.
          In this version, we are not storing under retrieval
          specifications where the relation field is
          wild-carded. To permit retrieval of assertions with
          the relation field variable
          (binding the relation field), remove the SUB1 and
          the CONS of T at SLOOPJB. Also, remove the ADDH just
          before SLOOPJB.)


          (SETQ LEN (SUB1 (LENGTH SPEC)))
          (SETQ A NIL)
          (RPTQ LEN (SETQ A (CONS NIL A)))
          (ADDH (MATCHER (CONS T A)
                         SPEC)
                NODENAME)
      SLOOPJB
          (ADDH (MATCHER (CONS T (SETQ A (BUMP A)))
                         SPEC)
                NODENAME)
          (COND
            ((MEMB NIL A)
              (GO SLOOPJB)))
          (ENDSTREAM (GETSH SPEC))
          (RETURN NODENAME])
```

[127]

```
(STATE
  [NLAMBDA L                                        (* edited:
                                                    " 6-Aug-79 17:31")

          (* STATE works like DENY and MAYBE, but gives the
```

```
          assertion a confidence of 1.0.)


    (CASSERT L 1.0])
)
(DECLARE: DONTEVAL@LOAD DOEVAL@COMPILE DONTCOPY COMPILERVARS

(ADDTOVAR NLAMA STATE MAYBE DENY)

(ADDTOVAR NLAML )

(ADDTOVAR LAMA )
)
(DECLARE: DONTCOPY
  (FILEMAP (NIL (587 8708 (ASSERT 599 . 1519) (BUMP 1523 . 2340) (CASSERT
2344 . 3601) (DENY 3605 . 4054) (GETUPLE 4058 . 4347) (MATCHER 4351 .
5391) (MAYBE 5395 . 5654) (RETRIEVER 5658 . 7014) (RETVARS 7018 . 7392)
(SERT 7396 . 8408) (STATE 8412 . 8705)))))
STOP
```

```
(FILECREATED " 6-Aug-79 19:06:57" <RBECHTAL>MEMORY..17 17907

     previous date: "23-Jul-79 08:04:36" <RBECHTAL>MEMORY..15)


(PRETTYCOMPRINT MEMORYCOMS)

(RPAQQ MEMORYCOMS ((VARS * (APPEND MEMORYVARS ASSERTIONS))
        [IFPROP (DERIVE DERIVE* FROM FROM* NEGFROM NEGFROM* SPLIT MB MD)
                *
                (APPEND ASSERTIONS [MAPCAR ASSERTIONS
                                           (FUNCTION
                                             (LAMBDA
                                               (X)
                                               (GETPROP X (QUOTE FROM*]
                        (MAPCAR ASSERTIONS (FUNCTION
                                    (LAMBDA (Y)
                                            (GETPROP Y (QUOTE DERIVE*]
        (P (CREATH MEMSIZE)
           [MAPC ASSERTIONS (FUNCTION (LAMBDA (Q)
                                              (SERT (EVAL Q)
                                                    Q]
           (PRIN1 "Memory Reinitialized")
           (TERPRI))))

(RPAQQ MEMSIZE 4374)

(RPAQQ GENNUM 10175)

(RPAQQ ASSERTIONS (A0175 A0174 A0173 A0172 A0171 A0170 A0169 A0168
                         A0167 A0166 A0165 A0164 A0163 A0162 A0161
                         A0160 A0159 A0158 A0157 A0156 A0155 A0154
                         A0153 A0152 A0151 A0150 A0149 A0148 A0147
                         A0146 A0145 A0144 A0143 A0142 A0141 A0140
                         A0139 A0138 A0137 A0136 A0135 A0134 A0133
                         A0132 A0131 A0130 A0129 A0128 A0127 A0126
                         A0125 A0124 A0123 A0122 A0121 A0120 A0119
                         A0118 A0117 A0116 A0115 A0114 A0113 A0112
                         A0111 A0110 A0109 A0108 A0107 A0106 A0105
                         A0104 A0103 A0102 A0101 A0100 A0099 A0098
                         A0097 A0096 A0095 A0094 A0093 A0092 A0091
                         A0090 A0089 A0088 A0087 A0086 A0085 A0084
                         A0083 A0082 A0081 A0080 A0079 A0078 A0077
                         A0076 A0075 A0074 A0073 A0072 A0071 A0070
                         A0069 A0068 A0067 A0066 A0065 A0064 A0063
                         A0062 A0061 A0060 A0059 A0058 A0057 A0056
                         A0055 A0054 A0053 A0052 A0051 A0050 A0049
                         A0048 A0047 A0046 A0045 A0044 A0043 A0042
                         A0041 A0040 A0039 A0038 A0037 A0036 A0035
                         A0034 A0033 A0032 A0031 A0030 A0029 A0028
                         A0027 A0026 A0025 A0024 A0023 A0022 A0021
                         A0020 A0019 A0018 A0017 A0016 A0015))

(RPAQQ MEMORYVARS (MEMSIZE GENNUM ASSERTIONS MEMORYVARS SYMBOLS))

(RPAQQ SYMBOLS NIL)
```

```
(RPAQQ A0175 (CLASS VIKING S-3A))
(RPAQQ A0174 (MEDIUM VIKING AIR))
(RPAQQ A0173 (TYPE VIKING RECONNISANCE))
(RPAQQ A0172 (ID-AMPLIFY VIKING MIL-AUXIL))
(RPAQQ A0171 (ID VIKING FRIEND))
(RPAQQ A0170 (PLATFORM VIKING))
(RPAQQ A0169 (CLASS SEASPRITE SH-2F))
(RPAQQ A0168 (MEDIUM SEASPRITE AIR))
(RPAQQ A0167 (TYPE SEASPRITE HELICOPTER))
(RPAQQ A0166 (ID-AMPLIFY SEASPRITE MIL-BATTLE))
(RPAQQ A0165 (ID SEASPRITE FRIEND))
(RPAQQ A0164 (PLATFORM SEASPRITE))
(RPAQQ A0163 (CLASS ORION P-3C))
(RPAQQ A0162 (MEDIUM ORION AIR))
(RPAQQ A0161 (TYPE ORION RECONNISANCE))
(RPAQQ A0160 (ID-AMPLIFY ORION MIL-AUXIL))
(RPAQQ A0159 (ID ORION FRIEND))
(RPAQQ A0158 (PLATFORM ORION))
(RPAQQ A0157 (CLASS HORMONE KA-25))
(RPAQQ A0156 (MEDIUM HORMONE AIR))
(RPAQQ A0155 (TYPE HORMONE HELICOPTER))
(RPAQQ A0154 (ID-AMPLIFY HORMONE MIL-BATTLE))
(RPAQQ A0153 (ID HORMONE HOSTILE))
(RPAQQ A0152 (PLATFORM HORMONE))
(RPAQQ A0151 (CLASS HAWKEYE E-2B))
(RPAQQ A0150 (MEDIUM HAWKEYE AIR))
(RPAQQ A0149 (TYPE HAWKEYE RECONNISANCE))
(RPAQQ A0148 (ID-AMPLIFY HAWKEYE MIL-AUXIL))
(RPAQQ A0147 (ID HAWKEYE FRIEND))
```

```
(RPAQQ A0146 (PLATFORM HAWKEYE))

(RPAQQ A0145 (CLASS HARRIER AV-8A))

(RPAQQ A0144 (MEDIUM HARRIER AIR))

(RPAQQ A0143 (TYPE HARRIER FIGHTER))

(RPAQQ A0142 (ID-AMPLIFY HARRIER MIL-BATTLE))

(RPAQQ A0141 (ID HARRIER FRIEND))

(RPAQQ A0140 (PLATFORM HARRIER))

(RPAQQ A0139 (CLASS FOXBAT MIG25))

(RPAQQ A0138 (MEDIUM FOXBAT AIR))

(RPAQQ A0137 (TYPE FOXBAT FIGHTER))

(RPAQQ A0136 (ID-AMPLIFY FOXBAT MIL-BATTLE))

(RPAQQ A0135 (ID FOXBAT HOSTILE))

(RPAQQ A0134 (PLATFORM FOXBAT))

(RPAQQ A0133 (CLASS CORSAIR A-7))

(RPAQQ A0132 (MEDIUM CORSAIR AIR))

(RPAQQ A0131 (TYPE CORSAIR FIGHTER))

(RPAQQ A0130 (ID-AMPLIFY CORSAIR MIL-BATTLE))

(RPAQQ A0129 (ID CORSAIR FRIEND))

(RPAQQ A0128 (PLATFORM CORSAIR))

(RPAQQ A0127 (CLASS BACKFIRE RV-G))

(RPAQQ A0126 (MEDIUM BACKFIRE AIR))

(RPAQQ A0125 (TYPE BACKFIRE BOMBER))

(RPAQQ A0124 (ID-AMPLIFY BACKFIRE MIL-BATTLE))

(RPAQQ A0123 (ID BACKFIRE HOSTILE))

(RPAQQ A0122 (PLATFORM BACKFIRE))

(RPAQQ A0121 (CLASS RATHBURNE KNOX))

(RPAQQ A0120 (MEDIUM RATHBURNE SURFACE))

(RPAQQ A0119 (TYPE RATHBURNE FRIGATE))
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(RPAQQ A0118 (ID-AMPLIFY RATHBURNE MIL-BATTLE))
(RPAQQ A0117 (ID RATHBURNE FRIEND))
(RPAQQ A0116 (PLATFORM RATHBURNE))
(RPAQQ A0115 (CLASS YANK-1 YANKEE))
(RPAQQ A0114 (MEDIUM YANK-1 SUB))
(RPAQQ A0113 (TYPE YANK-1 SUB))
(RPAQQ A0112 (ID-AMPLIFY YANK-1 MIL-BATTLE))
(RPAQQ A0111 (ID YANK-1 HOSTILE))
(RPAQQ A0110 (PLATFORM YANK-1))
(RPAQQ A0109 (CLASS WAINWRIGHT BELKNAP))
(RPAQQ A0108 (MEDIUM WAINWRIGHT SURFACE))
(RPAQQ A0107 (TYPE WAINWRIGHT CRUISER))
(RPAQQ A0106 (ID-AMPLIFY WAINWRIGHT MIL-BATTLE))
(RPAQQ A0105 (ID WAINWRIGHT FRIEND))
(RPAQQ A0104 (PLATFORM WAINWRIGHT))
(RPAQQ A0103 (CLASS SUNFISH STURGEON))
(RPAQQ A0102 (MEDIUM SUNFISH SUB))
(RPAQQ A0101 (TYPE SUNFISH SUB))
(RPAQQ A0100 (ID-AMPLIFY SUNFISH MIL-BATTLE))
(RPAQQ A0099 (ID SUNFISH FRIEND))
(RPAQQ A0098 (PLATFORM SUNFISH))
(RPAQQ A0097 (CLASS PROVORNY KASHIN))
(RPAQQ A0096 (MEDIUM PROVORNY SURFACE))
(RPAQQ A0095 (TYPE PROVORNY DESTROYER))
(RPAQQ A0094 (ID-AMPLIFY PROVORNY MIL-BATTLE))
(RPAQQ A0093 (ID PROVORNY HOSTILE))
(RPAQQ A0092 (PLATFORM PROVORNY))
(RPAQQ A0091 (CLASS MINSK KIEV))
(RPAQQ A0090 (MEDIUM MINSK SURFACE))
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(RPAQQ A0089 (TYPE MINSK CARRIER))
(RPAQQ A0088 (ID-AMPLIFY MINSK MIL-BATTLE))
(RPAQQ A0087 (ID MINSK HOSTILE))
(RPAQQ A0086 (PLATFORM MINSK))
(RPAQQ A0085 (CLASS MEYERCORD KNOX))
(RPAQQ A0084 (MEDIUM MEYERCORD SURFACE))
(RPAQQ A0083 (TYPE MEYERCORD FRIGATE))
(RPAQQ A0082 (ID-AMPLIFY MEYERCORD MIL-BATTLE))
(RPAQQ A0081 (ID MEYERCORD FRIEND))
(RPAQQ A0080 (PLATFORM MEYERCORD))
(RPAQQ A0079 (CLASS LAWRENCE CHAS.ADAMS))
(RPAQQ A0078 (MEDIUM LAWRENCE SURFACE))
(RPAQQ A0077 (TYPE LAWRENCE DESTROYER))
(RPAQQ A0076 (ID-AMPLIFY LAWRENCE MIL-BATTLE))
(RPAQQ A0075 (ID LAWRENCE FRIEND))
(RPAQQ A0074 (PLATFORM LAWRENCE))
(RPAQQ A0073 (CLASS HASSAYAMPA NEOSHO))
(RPAQQ A0072 (MEDIUM HASSAYAMPA SURFACE))
(RPAQQ A0071 (TYPE HASSAYAMPA OILER))
(RPAQQ A0070 (ID-AMPLIFY HASSAYAMPA MIL-AUXIL))
(RPAQQ A0069 (ID HASSAYAMPA FRIEND))
(RPAQQ A0068 (PLATFORM HASSAYAMPA))
(RPAQQ A0067 (CLASS HALSEY LEAHY))
(RPAQQ A0066 (MEDIUM HALSEY SURFACE))
(RPAQQ A0065 (TYPE HALSEY CRUISER))
(RPAQQ A0064 (ID-AMPLIFY HALSEY MIL-BATTLE))
(RPAQQ A0063 (ID HALSEY FRIEND))
(RPAQQ A0062 (PLATFORM HALSEY))
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(RPAQQ A0061 (CLASS ECHO-1 ECHOII))

(RPAQQ A0060 (MEDIUM ECHO-1 SUB))

(RPAQQ A0059 (TYPE ECHO-1 SUB))

(RPAQQ A0058 (ID-AMPLIFY ECHO-1 MIL-BATTLE))

(RPAQQ A0057 (ID ECHO-1 HOSTILE))

(RPAQQ A0056 (PLATFORM ECHO-1))

(RPAQQ A0055 (CLASS DESNA KAZBEK))

(RPAQQ A0054 (MEDIUM DESNA SURFACE))

(RPAQQ A0053 (TYPE DESNA OILER))

(RPAQQ A0052 (ID-AMPLIFY DESNA MIL-AUXIL))

(RPAQQ A0051 (ID DESNA HOSTILE))

(RPAQQ A0050 (PLATFORM DESNA))

(RPAQQ A0049 (CLASS CONSTELLATION KITTYHAWK))

(RPAQQ A0048 (MEDIUM CONSTELLATION SURFACE))

(RPAQQ A0047 (TYPE CONSTELLATION CARRIER))

(RPAQQ A0046 (ID-AMPLIFY CONSTELLATION MIL-BATTLE))

(RPAQQ A0045 (ID CONSTELLATION FRIEND))

(RPAQQ A0044 (PLATFORM CONSTELLATION))

(RPAQQ A0043 (CLASS ADMIRAL% MAKAROV KRESTAII))

(RPAQQ A0042 (MEDIUM ADMIRAL% MAKAROV SURFACE))

(RPAQQ A0041 (TYPE ADMIRAL% MAKAROV CRUISER))

(RPAQQ A0040 (ID-AMPLIFY ADMIRAL% MAKAROV MIL-BATTLE))

(RPAQQ A0039 (ID ADMIRAL% MAKAROV HOSTILE))

(RPAQQ A0038 (PLATFORM ADMIRAL% MAKAROV))

(RPAQQ A0037 (CLASS ADMIRAL% GOLOVKO KYNDA))

(RPAQQ A0036 (MEDIUM ADMIRAL% GOLOVKO SURFACE))

(RPAQQ A0035 (TYPE ADMIRAL% GOLOVKO CRUISER))

(RPAQQ A0034 (ID-AMPLIFY ADMIRAL% GOLOVKO MIL-BATTLE))

(RPAQQ A0033 (ID ADMIRAL% GOLOVKO HOSTILE))
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(RPAQQ A0032 (PLATFORM ADMIRAL% GOLOVKO))

(RPAQQ A0031 (CLASS CONNOLE KNOX))

(RPAQQ A0030 (TYPE CONNOLE FRIGATE))

(RPAQQ A0029 (ID-AMPLIFY CONNOLE MIL-BATTLE))

(RPAQQ A0028 (ID CONNOLE FRIEND))

(RPAQQ A0027 (OWNSHIP CONNOLE))

(RPAQQ A0026 (LOCATION LANE3 ((55.66 -39.84)
                              (57.23 -36.36)
                              (58.56 -32.89)
                              (59.77 -29.01)
                              (61.17 -23.79)
                              (62.08 -19.37)
                              (62.99 -13.96)
                              (63.79 -6.72))))

(RPAQQ A0025 (LOCATION LANE2 ((56.04 -42.25)
                              (58.45 -37.9)
                              (60.37 -33.75)
                              (61.85 -29.94)
                              (63.19 -26.0)
                              (64.01 -22.99))))

(RPAQQ A0024 (LOCATION LANE1 ((68.93 -13.82)
                              (68.39 -16.57)
                              (66.79 -23.11)
                              (66.11 -25.32)
                              (65.02 -28.53)
                              (64.19 -30.47)
                              (63.34 -32.47)
                              (62.11 -35.08)
                              (60.64 -37.76)
                              (59.21 -40.16)
                              (58.14 -41.7))))

(RPAQQ A0023 (FROM-PORT LANE3 ST.JOHNS))

(RPAQQ A0022 (TO-PORT LANE3 MURMANSK))

(RPAQQ A0021 (FROM-PORT LANE2 ST.JOHNS))

(RPAQQ A0020 (TO-PORT LANE2 REYKJAVIK))

(RPAQQ A0019 (FROM-PORT LANE1 MURMANSK))

(RPAQQ A0018 (TO-PORT LANE1 REYKJAVIK))

(RPAQQ A0017 (MERCHANTLANE LANE3))

(RPAQQ A0016 (MERCHANTLANE LANE2))
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(RPAQQ A0015 (MERCHANTLANE LANE1))
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(PUTPROPS A0017 MD 0.0)

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(PUTPROPS A0015 MD 0.0)
(CREATH MEMSIZE)
[MAPC ASSERTIONS (FUNCTION (LAMBDA (Q)
                                   (SERT (EVAL Q)
                                         Q]
(PRIN1 "Memory Reinitialized")
(TERPRI)
(DECLARE: DONTCOPY
  (FILEMAP (NIL)))
STOP
```
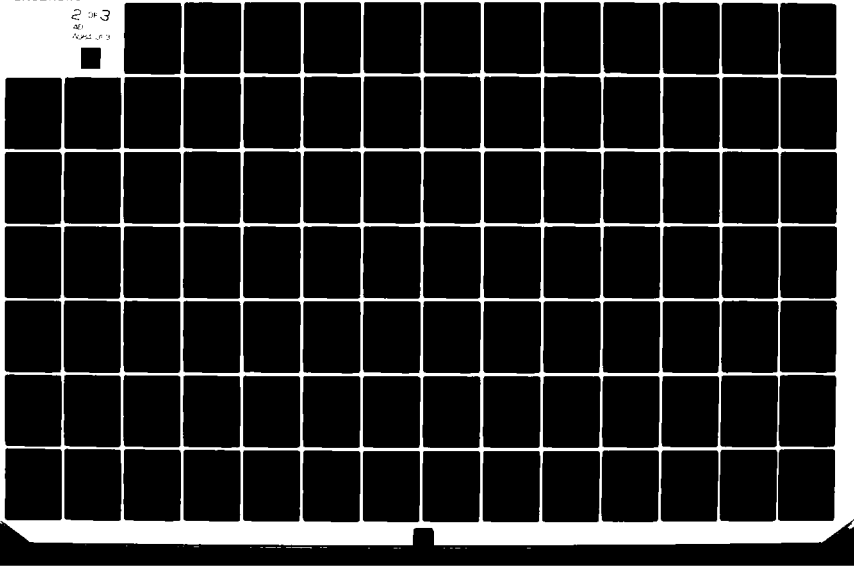
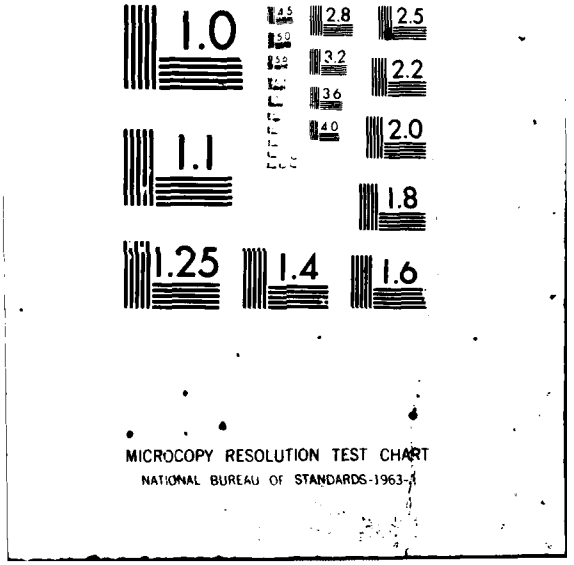

```
(FILECREATED "23-Aug-79 17:56:55" <RBECHTAL>MSGMTR..27 16895

     changes to:  WEATHERMSG

     previous date: " 6-Aug-79 09:36:54" <RBECHTAL>MSGMTR..26)

(PRETTYCOMPRINT MSGMTRCOMS)

(RPAQQ MSGMTRCOMS ((VARS * MSGMTRVARS)
                   (FNS * MSGMTRFNS)))

(RPAQQ MSGMTRVARS (DSPLAYFLG MSGFILE OWNSHIP SENSORANGE CURTIME))

(RPAQQ DSPLAYFLG NIL)

(RPAQQ MSGFILE SCENE.ICE)

(RPAQQ OWNSHIP CONNOLE)

(RPAQQ SENSORANGE 25)

(RPAQQ CURTIME 0)

(RPAQQ MSGMTRFNS (BEYONDINTEREST DESCRIBEMSG DISPCHECK DISPLAY DISPLOB
                                 DISPMARK EWMSG GREATESTPROB IDENT
                                 INTERPOLABLE MEDIUM MELD MIDP MSGMTR
                                 NEWSYM OWNMSG OWNPOS SENSORMSG
                                 TWO-PLACE WEATHERMSG))
(DEFINEQ

                                                                [128]

(BEYONDINTEREST
  [LAMBDA (TXT)                                          (* edited:
                                                         "31-Jul-79 09:21")
    NIL])

                                                                [129]

(DESCRIBEMSG
  [LAMBDA (TXT)                                          (* edited:
                                                         " 6-Aug-79 08:53")

          (* DESCRIBEMSG prints the information contained in a
          message in a relatively nice format for the user.
          The function itself is fairly simple, if tedious.
          After determining the type of message, the
          information is printed. Messages concerning the home
          ship are ignored. After printing, if display is
          enabled, a picture containing the new location is
          drawn.)

    (PROG ((WKNM (CAR TXT))
           (SOURCE (CADR TXT))
```

AD-A084 053 SDC INTEGRATED SERVICES INC SAN DIEGO CA F/G 9/2
STAMMER2 PRODUCTION SYSTEM FOR TACTICAL SITUATION ASSESSMENT. V--ETC(U)
OCT 79 D C MCCALL, P H MORRIS, D F KIBLER N00123-76-C-0172
UNCLASSIFIED NOSC-TD-298-VOL-2 NL

2 OF 3
AD
A084 053




1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

```
        (TIME (CAR (LAST TXT)))
        POS)
       (SETQ CURTIME TIME)
       (COND
         ((EQ WKNM OWNSHIP)
           (RETURN)))
       [COND
         ((EQ (CADR TXT)
              (QUOTE WEATHER))
           (TERPRI)
           (SPACES 5)
           (PRIN1 "Weather report.")
           (TERPRI)
           (SPACES 5)
           (PRIN1 "Storm centered at ")
           (PRIN1 (CENTROID (CADDR TXT)))
           (TERPRI)
           (COND
             (DSPLAYFLG (TERPRI)
                        (SPACES 10)
                        (PRIN1 "Display follows")
                        (TERPRI)
                        (WAITER)
                        (DSPCMD "PTR PL,ST")))
           (RETURN))
         [(NUMBERP (CADDDR TXT))
           (SETQ POS (LIST (CADDR TXT)
                           (CADDDR TXT)))
           (COND
             ((OR (EQ SOURCE (QUOTE RADAR))
                  (EQ SOURCE (QUOTE SONAR)))
               (TERPRI)
               (SPACES 5)
               (PRIN1 SOURCE)
               (PRIN1 " contact at ")
               (PRIN1 POS)
               (PRIN1 "  Time: ")
               (PRIN1 TIME))
             (T (TERPRI)
                (SPACES 5)
                (PRIN1 "Message received from external source.")
                (TERPRI)
                (SPACES 5)
                (PRIN1 "Something detected at ")
                (PRIN1 POS)
                (PRIN1 "  Time: ")
                (PRIN1 TIME]
         (T (SETQ POS (CADDR TXT))
            (COND
              ((EQ SOURCE (QUOTE EXTERNAL))
                (TERPRI)
                (SPACES 5)
                (PRIN1
"Message from external source. Heard something at bearing ")
                (PRIN1 POS)
                [SETQ POS (LIST (CAR (CDDDDR TXT))
                                (CADR (CDDDDR TXT]
```

```
                    (TERPRI)
                    (SPACES 5)
                    (PRIN1 "Detector located at ")
                    (PRIN1 POS)
                    (PRIN1 "  Time: ")
                    (PRIN1 TIME))
                   (T (TERPRI)
                      (SPACES 5)
                      (PRIN1 "Passive detection. Heard ")
                      (PRIN1 (CADDDR TXT))
                      (PRIN1 " at bearing ")
                      (PRIN1 POS)
                      (PRIN1 "  Time: ")
                      (PRIN1 TIME]
            (TERPRI)
            (SPACES 5)
            (PRIN1 "Associated with track ")
            (PRIN1 WKNM)
            (TERPRI)
            (TERPRI)
            (COND
              (DSPLAYFLG (PRIN1 "       Display follows.")
                         (TERPRI)
                         (WAITER)
                         (DSPCMD "PTR PL"])
```

[130]

```
(DISPCHECK
  [LAMBDA (NAME)                                    (* edited:
                                                    " 6-Aug-79 08:55")

          (* This function checks the property list of a
          platform name to determine if the platform has
          already been placed in the display.
          If not, a DSPADDTRH needs to be performed.)

    (GETPROP NAME (QUOTE INDISPLAY])
```

[131]

```
(DISPLAY
  [LAMBDA (PLATNAME LAT LON TIME)                   (* edited:
                                                    " 6-Aug-79 08:56")

          (* DISPLAY does the necessary stuff to get a new
          platform sighting added to the display file.
          If the platform is new to the display, it is added
          to the display file, otherwise, only the new
          sighting is added.)

    (COND
      (DSPLAYFLG (COND
                   ((DISPCHECK PLATNAME)
                     (DSPADDINC PLATNAME LAT LON (FLOAT TIME)))
```

```
                (T (DSPADDTRH PLATNAME (QUOTE PL)
                              (MELD (IDENT PLATNAME)
                                    (MEDIUM PLATNAME)))
                   (DISPMARK PLATNAME)
                   (DSPADDINC PLATNAME LAT LON (FLOAT TIME])
```

[132]

```
(DISPLOB
  [LAMBDA (PNAME SPOS DPOS TIME)                    (* edited:
                                                    " 6-Aug-79 08:59")

          (* DISPLOB displays lines of bearing
          (such as those obtained by EW sightings) by adding
          the midpoint of a line drawn from the detecting
          craft location to a point maxsensorange miles
          (50) along the given bearing to the display.)

    (PROG (TEMP1 TEMP2)
          (COND
            (DSPLAYFLG (SETQ TEMP1 (MIDP (CAR SPOS)
                                         (CAR DPOS)))
                       (SETQ TEMP2 (MIDP (CADR SPOS)
                                         (CADR DPOS)))
                       (DISPLAY PNAME TEMP1 TEMP2 TIME])
```

[133]

```
(DISPMARK
  [LAMBDA (NAME)                                    (* edited:
                                                    " 6-Aug-79 09:00")

          (* DISPMARK places a marker on the property list of
          platforms that have been entered into the display
          file.)

    (PUTPROP NAME (QUOTE INDISPLAY)
             T])
```

[134]

```
(EWMSG
  [LAMBDA (TXT EXTFLG)                              (* edited:
                                                    " 6-Aug-79 09:04")

          (* EWMSG adds information contained in EW messages
          to the network. The information includes position
          information (a line from the detecting platform
          along the LOB for 50 miles), the time of the
          detection, and, if the detection was made by the
          homeship, the emitter detected.)

    (PROG ((SNODE (NEWSYM (QUOTE SIGHTING)))
           (WKNM (CAR TXT))
```

```
          (SOURCE (CADR TXT))
          (BEAR (CADDR TXT))
          (EMIT (CADDDR TXT))
          TEMPLACE1 TEMPLACE2 TIME)
         (CASSERT (LIST (QUOTE SOURCE)
                        SNODE SOURCE)
                  1.0)
         (COND
           (EXTFLG (SETQ TIME (CADDDR (CDDDR TXT)))
                   (CASSERT
                     [LIST (QUOTE POSITION)
                           SNODE
                           (LIST [SETQ TEMPLACE1
                                       (LIST (CADDR (CDDR TXT))
                                             (CADDR (CDDDR TXT]
                                 (SETQ TEMPLACE2
                                   (GETPOINT TEMPLACE1 BEAR SENSORANGE]
                     1.0)
                   (CASSERT (LIST (QUOTE TOS)
                                  SNODE TIME)
                            1.0))
           (T (SETQ TIME (CADR (CDDDR TXT)))
              (CASSERT (LIST (QUOTE TOS)
                             SNODE TIME)
                       1.0)
              (CASSERT (LIST (QUOTE EMITTER)
                             SNODE EMIT)
                       1.0)
              (CASSERT [LIST (QUOTE POSITION)
                             SNODE
                             (LIST (SETQ TEMPLACE1 (OWNPOS TIME))
                                   (SETQ TEMPLACE2
                                     (GETPOINT TEMPLACE1 BEAR
                                               SENSORANGE]
                       1.0)))
         (CASSERT (LIST (QUOTE SIGHTING)
                        WKNM SNODE)
                  1.0)
         (DISPLOB WKNM TEMPLACE1 TEMPLACE2 TIME])
```

[135]

```
(GREATESTPROB
  [LAMBDA (POSLIST)                                    (* edited:
                                                       " 6-Aug-79 09:07")

          (* GREATESTPROB takes a list of answers of the form
          that RETRIEVER returns, and examines them, returning
          the element whose confidence is highest.
          If no element has positive confidence, or if more
          than one element is equally likely
          (at greatest confidence), GREATESTPROB returns NIL.)


     (PROG (ANS (ANSCON 0.0))
           [MAPC POSLIST (FUNCTION (LAMBDA (A)
                     (COND
```

```
                    ((GREATERP (GETCON (CAR A))
                               ANSCON)
                      (SETQ ANSCON (GETCON (CAR A)))
                      (SETQ ANS A))
                    ((EQP ANSCON (GETCON (CAR A)))
                      (SETQ ANS NIL]
          (RETURN ANS])
```

[136]

```
(IDENT
  [LAMBDA (NAME)                                    (* edited:
                                                    " 6-Aug-79 09:09")

          (* Used in display initialization of platforms, this
          attempts to determine whether the platform is
          FRIEND, HOSTILE, or UNKNOWN, and returns the
          apprpriate. Default is UNKNOWN.)


    (PROG (POSIB ANS)
          [SETQ POSIB (RETRIEVER (LIST (QUOTE ID)
                                       NAME
                                       (QUOTE *WHAID]
          (SETQ ANS (GREATESTPROB POSIB))
          (COND
            (ANS (RETURN (CDDR ANS)))
            (T (RETURN (QUOTE UNKNOWN])
```

[137]

```
(INTERPOLABLE
  [LAMBDA (TXT)                                     (* edited:
                                                    "31-Jul-79 09:21")
    NIL])
```

[138]

```
(MEDIUM
  [LAMBDA (NAME)                                    (* edited:
                                                    " 6-Aug-79 09:11")

          (* Determines the medium of a platform.
          Default is SURFACE (as opposed to SUB or AIR).)


    (PROG (TEMP1 RETURNER)
          [SETQ TEMP1 (RETRIEVER (LIST (QUOTE MEDIUM)
                                       NAME
                                       (QUOTE **WHAMED]
          (SETQ RETURNER (GREATESTPROB TEMP1))
          (COND
            (RETURNER (RETURN (CDDR RETURNER)))
            (T (RETURN (QUOTE SURFACE])
```

[139]

```
(MELD
  [LAMBDA (ID MED)                                    (* edited:
                                                      " 6-Aug-79 09:12")

          (* Creates a DSPLA type to be used for platforms.
          The type controls the symbol used in the display for
          a platform.)


    (PROG (A B)
          (SELECTQ ID
                   (UNKNOWN (SETQ A (QUOTE U)))
                   (FRIEND (SETQ A (QUOTE F)))
                   (HOSTILE (SETQ A (QUOTE H)))
                   (SETQ A (QUOTE U)))
          (SELECTQ MED
                   (AIR (SETQ B (QUOTE A)))
                   (SURFACE (SETQ B (QUOTE S)))
                   (SUB (SETQ B (QUOTE U)))
                   (SETQ B (QUOTE S)))
          (RETURN (PACK (LIST A B])
```

[140]

```
(MIDP
  [LAMBDA (P1 P2)                                     (* edited:
                                                      " 6-Aug-79 09:15")

          (* Returns the "average" of two latitudes or
          longitudes. The 180 degree check is to insure that
          the shortest distance is taken when changing sign,
          especially for longitude.)


    (PROG (TEMP2)
          (SETQ TEMP2 (FDIFFERENCE P1 P2))
          (COND
            [(GREATERP (ABS TEMP2)
                       180.0)
              (RETURN (MINUS (TWO-PLACE (FQUOTIENT TEMP2 2.0]
            (T (RETURN (TWO-PLACE (FQUOTIENT (FPLUS P1 P2)
                                             2.0])
```

[141]

```
(MSGMTR
  [LAMBDA NIL                                         (* edited:
                                                      " 6-Aug-79 09:19")

          (* MSGMTR reads a message (LISP S-expression) from
          the designated message file, freezes deduction,
          passes the message to the appropriate handler, then
          unfreezes the deductions. Returns IGNORE in those
          cases where the message should have no effect on
          output, returns NIL if there are no more messages,
```

```
        and returns T otherwise. Messages about the home
        ship are ignored for printout.
        Messages out of range, or predictable from existing
        information are ignored.)


    (PROG (OLDIN MSG)
          (SETQ OLDIN (INPUT))
          (INFILE MSGFILE)
          (SETQ MSG (READ))
          (INFILE OLDIN)
          (FREEZE)
          [COND
            ((EQ MSG (QUOTE STOP))
              (CLOSEF? MSGFILE)
              (UNFREEZE)
              (RETURN))
            ((EQ (CAR MSG)
                 OWNSHIP)
              (OWNMSG MSG)
              (UNFREEZE)
              (RETURN (QUOTE IGNORE)))
            ((BEYONDINTEREST MSG)
              (DESCRIBEMSG MSG)
              (PRIN1 "Beyond area of interest. Ignored.")
              (TERPRI)
              (UNFREEZE)
              (RETURN (QUOTE IGNORE)))
            ((INTERPOLABLE MSG)
              (DESCRIBEMSG MSG)
              (PRIN1 "Predictable from existing information. Ignored.")
              (TERPRI)
              (UNFREEZE)
              (RETURN (QUOTE IGNORE)))
            ((EQ (CADR MSG)
                 (QUOTE WEATHER))
              (WEATHERMSG MSG))
            ((NUMBERP (CADDDR MSG))
              (SENSORMSG MSG))
            (T (COND
                 ((EQ (CADR MSG)
                      (QUOTE EW))
                   (EWMSG MSG))
                 (T (EWMSG MSG T]
          (UNFREEZE)
          (DESCRIBEMSG MSG)
          (RETURN T])
```

[142]

```
(NEWSYM
  [LAMBDA (NAME)                                    (* edited:
                                                    " 6-Aug-79 09:21")


        (* NEWSYM is a method of generating custom atoms.
        It acts like GENSYM, only maintains a separate
        counter for each atom, permits atoms of arbitrary
```

```
        length, and has no leading zeroes in the numeric
        part. It is also less efficient, both in time and
        space.)


    [COND
      [(GETPROP NAME (QUOTE COUNTER))
        (PUTPROP NAME (QUOTE COUNTER)
                 (ADD1 (GETPROP NAME (QUOTE COUNTER]
      (T (PUTPROP NAME (QUOTE COUNTER)
                 1)
         (SETQ SYMBOLS (CONS NAME SYMBOLS]
    (PACK (APPEND (UNPACK NAME)
                  (UNPACK (GETPROP NAME (QUOTE COUNTER])
```

[143]

```
(OWNMSG
  [LAMBDA (TXT)                                    (* edited:
                                                   " 6-Aug-79 09:23")

        (* OWNMSG updates the location of the home ship in
        the data base. Time and location are added.)


    (PROG [(SNODE (NEWSYM (QUOTE SIGHTING]
          (CASSERT (LIST (QUOTE TOS)
                         SNODE
                         (CADDDR TXT))
                   1.0)
          (CASSERT [LIST (QUOTE POSITION)
                         SNODE
                         (LIST (LIST (CADR TXT)
                                     (CADDR TXT]
                   1.0)
          (CASSERT (LIST (QUOTE SIGHTING)
                         OWNSHIP SNODE)
                   1.0)
          (DISPLAY OWNSHIP (CADR TXT)
                   (CADDR TXT)
                   (CADDDR TXT])
```

[144]

```
(OWNPOS
  [LAMBDA (TIME)                                   (* edited:
                                                   " 6-Aug-79 09:23")
                                                   (* OWNPOS returns the
                                                   location of the home
                                                   ship at a given time)

    (CAR (PLATPOS OWNSHIP TIME])
```

[145]

```
(SENSORMSG
  [LAMBDA (TXT)                                    (* edited:
                                                   " 6-Aug-79 09:25")
```

```
        (* SENSORMSG adds information from sonar and radar
        sightings to the data base. Sonar and radar messages
        include time and location information.
        The source of the message is also added.
        If there is an indication of video
        (radar) or return (sonar) strength, this is also
        added.)


    (PROG [(SNODE (NEWSYM (QUOTE SIGHTING)))
           (WKNM (CAR TXT))
           (SOURCE (CADR TXT))
           (LAT (CADDR TXT))
           (STR (CAR (CDDDDR TXT)))
           (LON (CADDDR TXT))
           (TIME (CAR (LAST TXT]
          (CASSERT (LIST (QUOTE POSITION)
                         SNODE
                         (LIST (LIST LAT LON)))
                   1.0)
          (CASSERT (LIST (QUOTE SOURCE)
                         SNODE SOURCE)
                   1.0)
          (CASSERT (LIST (QUOTE TOS)
                         SNODE TIME)
                   1.0)
          (COND
            ((NOT (EQUAL STR TIME))
              (CASSERT (LIST (QUOTE STRENGTH)
                             SNODE STR)
                       1.0)))
          (CASSERT (LIST (QUOTE SIGHTING)
                         WKNM SNODE)
                   1.0)
          (DISPLAY WKNM LAT LON TIME])
```

[146]

```
(TWO-PLACE
  [LAMBDA (X)                                    (* edited:
                                                 " 6-Aug-79 09:26")

        (* TWO-PLACE takes a number as argument, and returns
        that number rounded to two decimal places.)


    (FQUOTIENT (FIX (FPLUS .5 (FTIMES X 100.0)))
               100.0])
```

[147]

```
(WEATHERMSG
  [LAMBDA (TXT)                                  (* edited:
                                                 "23-Aug-79 17:56")

        (* WEATHERMSG adds the information in a weather
```

```
          report to memory. The information includes the
          polygon that dafines the location of the storm and
          the time that the storm was sighted.
          If appropriate, the location of the storm is added
          to the display.)


    (PROG ((SNAME (CAR TXT))
           (LOC (CADDR TXT))
           (TM (CADDDR TXT)))
          (CASSERT (LIST (QUOTE LOCATION)
                         SNAME LOC)
                   1.0)
          (CASSERT (LIST (QUOTE STORM)
                         SNAME)
                   1.0)
          (COND                                                    |
            (DSPLAYFLG (DSPADDTRH SNAME (QUOTE ST)                 |
                                  (QUOTE XX))                      |
                       (MAPC LOC (FUNCTION (LAMBDA (STVER)         |
                                 (DSPADDINC SNAME (CAR STVER)      |
                                            (CADR STVER)           |
                                            (FLOAT TM])
)
(DECLARE: DONTCOPY
  (FILEMAP (NIL (688 16871 (BEYONDINTEREST 700 . 813) (DESCRIBEMSG 817 .
3489) (DISPCHECK 3493 . 3926) (DISPLAY 3930 . 4671) (DISPLOB 4675 . 5350
) (DISPMARK 5354 . 5720) (EWMSG 5724 . 7356) (GREATESTPROB 7360 . 8173)
(IDENT 8177 . 8815) (INTERPOLABLE 8819 . 8930) (MEDIUM 8934 . 9480) (
MELD 9484 . 10157) (MIDP 10161 . 10805) (MSGMTR 10809 . 12682) (NEWSYM
12686 . 13472) (OWNMSG 13476 . 14150) (OWNPOS 14154 . 14426) (SENSORMSG
14430 . 15635) (TWO-PLACE 15639 . 15994) (WEATHERMSG 15998 . 16868)))))
STOP
```

```
(FILECREATED "28-Aug-79 11:42:07" <DKIBLER>NEWEXP.LSP.34 33327

     changes to:  NEWEXPVARS

     previous date: "28-Aug-79 11:35:20" <DKIBLER>NEWEXP.LSP.33)


(PRETTYCOMPRINT NEWEXPCOMS)

(RPAQQ NEWEXPCOMS [(VARS * NEWEXPVARS)
                   (IFPROP PRINFORMS * RELATIONS)
                   (IFPROP QHPRODS * STATES)
                   (FNS * NEWEXPFNS)
                   (P (LOAD (QUOTE QH.COM])

(RPAQQ NEWEXPVARS [(ASSERTION NIL)
        RELATIONS
        (RULE NIL)
        carriagereturn
        (SMALLNUMB (QUOTE (1 2 3 4 5 6 7 8 9)))
        STATES EXPLAINFLAG
        (DULLREL (QUOTE (NOT-FIRST NOT-LAST CONTACT SIGHTING
                                   INSIDE-A-MERCHANTLANE LESS-THAN
                                   GREATER-THAN PLATFORM SAME-AS
                                   FIRST-SIGHTING LAST-SIGHTING])

(RPAQ ASSERTION NIL)

(RPAQQ RELATIONS (CLASS OWNSHIP PLATFORM CONTACT SIGHTING SOURCE TOS
                        POSITION TYPE EMITTER DETECTION FIRST-SIGHTING
                        RADAR-MODE RANGE LESS-THAN STRENGTH MODE
                        GREATER-THAN SPEED LAND-DIST
                        REACHABLE-BY-A-COMBATANT MEDIUM INSIDE
                        INSIDE-A-MERCHANTLANE MERCHANTLANE IN-LANE
                        SUCCESSOR COURSE ROUGHLY-THE-SAME-COURSE-AS
                        ROUGHLY-THE-SAME-SPEED-AS ID ID-AMPLIFY
                        LOCATION TO-PORT FROM-PORT SAME-AS PATROL
                        POSSIBLE-REPORT CROSSPATHS GRAZE WENT-BEFORE
                        WENT-AFTER BLOCKED-FROM DISSIMILAR SWR
                        SIMPLY-WITHIN-REACH WITHIN-REACH NOT-FIRST
                        NOT-LAST ALIAS COURSEFROM SPEEDFROM))

(RPAQ RULE NIL)

(RPAQQ carriagereturn %
)

(RPAQQ SMALLNUMB (1 2 3 4 5 6 7 8 9))

(RPAQQ STATES (<EXPLTREE> <PLATIS> <VALIS> <ATTIS> <TYPIS> <IDIS>
          <IDAMPIS> <WHATFORM> <WHOSE2FORM> <WHOSEFORM> <TELLABT>
          <WHEREFORM> <WHEREITEM> <WHAT2FORM> <TYPE2> <ID2> <IDAMP2>
          <OCCURNUM> <OTHER2>))

(RPAQQ EXPLAINFLAG NIL)
```

```
(RPAQQ DULLREL (NOT-FIRST NOT-LAST CONTACT SIGHTING
                          INSIDE-A-MERCHANTLANE LESS-THAN GREATER-THAN
                          PLATFORM SAME-AS FIRST-SIGHTING LAST-SIGHTING)
)

(RPAQQ RELATIONS (CLASS OWNSHIP PLATFORM CONTACT SIGHTING SOURCE TOS
                        POSITION TYPE EMITTER DETECTION FIRST-SIGHTING
                        RADAR-MODE RANGE LESS-THAN STRENGTH MODE
                        GREATER-THAN SPEED LAND-DIST
                        REACHABLE-BY-A-COMBATANT MEDIUM INSIDE
                        INSIDE-A-MERCHANTLANE MERCHANTLANE IN-LANE
                        SUCCESSOR COURSE ROUGHLY-THE-SAME-COURSE-AS
                        ROUGHLY-THE-SAME-SPEED-AS ID ID-AMPLIFY
                        LOCATION TO-PORT FROM-PORT SAME-AS PATROL
                        POSSIBLE-REPORT CROSSPATHS GRAZE WENT-BEFORE
                        WENT-AFTER BLOCKED-FROM DISSIMILAR SWR
                        SIMPLY-WITHIN-REACH WITHIN-REACH NOT-FIRST
                        NOT-LAST ALIAS COURSEFROM SPEEDFROM))

(PUTPROPS CLASS PRINFORMS ((2 " is " (MODIFIER)
                              "a " 3 T)))

(PUTPROPS OWNSHIP PRINFORMS ((2 " is " (MODIFIER)
                                "the OWNSHIP" T)))

(PUTPROPS PLATFORM PRINFORMS ((2 " is " (MODIFIER)
                                 "a platform" T)
                              ("the platform " 2)))

(PUTPROPS CONTACT PRINFORMS ((2 " is " (MODIFIER)
                                "a contact" T)
                             ("the contact " 2)))

(PUTPROPS SIGHTING PRINFORMS ((3 " is " (MODIFIER)
                                 "a sighting of " 2 T)
                              (3 " is " (MODIFIER)
                                 "a sighting of ")
                              (" of ")))

(PUTPROPS SOURCE PRINFORMS ((3 " is " (MODIFIER)
                               "the source of " 2 T)
                            ("The source of " 2 " is " (MODIFIER)
                                                3)))

(PUTPROPS TOS PRINFORMS ((2 " occurred at " 3 T)
                         ("The time of " 2 " is " (MODIFIER)
                                                  3)))

(PUTPROPS POSITION PRINFORMS ((3 " is " (MODIFIER)
                                 "the position of " 2 T)
                              ("The position of " 2 " is " (MODIFIER)
                                                           3 T)))

(PUTPROPS TYPE PRINFORMS ((2 " is " (MODIFIER)
                             "a " 3 T)))

(PUTPROPS EMITTER PRINFORMS ((3 " is " (MODIFIER)
```

```
                                    "the emitter detected in " 3 T)))

(PUTPROPS DETECTION PRINFORMS ((2 " is " (MODIFIER)
                                   "a detection" T)
                               (" the detection " 2 T)))

(PUTPROPS FIRST-SIGHTING PRINFORMS ((3 " is " (MODIFIER)
                                       "the first sighting of " 2 T)
                                    ("the first sighting of ")))

(PUTPROPS RADAR-MODE PRINFORMS (("Radar was " (MODIFIER)
                                             "in mode " 2 T)))

(PUTPROPS RANGE PRINFORMS ((3 " is " (MODIFIER)
                              "the range of " 2 T)
                           (3 " is " (MODIFIER)
                              "the range of ")))

(PUTPROPS LESS-THAN PRINFORMS ((2 " is " (MODIFIER)
                                  "less than " 3 T)))

(PUTPROPS STRENGTH PRINFORMS (("Signal at " 2 " is " (MODIFIER)
                                          3 T)))

(PUTPROPS MODE PRINFORMS ((2 " is " (MODIFIER)
                             3 T)))

(PUTPROPS GREATER-THAN PRINFORMS ((2 " is " (MODIFIER)
                                     "greater than " 3 T)))

(PUTPROPS SPEED PRINFORMS ((3 " is " (MODIFIER)
                              "the speed of " 2 T)
                           (3 " is " (MODIFIER)
                              "the speed of ")))

(PUTPROPS LAND-DIST PRINFORMS ((2 " is " 3 " miles from land" T)))

(PUTPROPS REACHABLE-BY-A-COMBATANT PRINFORMS (("It is " (MODIFIER)

                                     "the case that some combatant"
                                                        T
                                "could have sailed to the position of "
                                                        2 T
                                     " by the time of the sighting"
                                                        T)))

(PUTPROPS MEDIUM PRINFORMS (("The medium of " 2 " is " (MODIFIER)
                                          3 T)))

(PUTPROPS INSIDE PRINFORMS ((2 " is " (MODIFIER)
                               "inside " 3 T)
                            (" is " (MODIFIER)
                                    "inside " 3 T)))

(PUTPROPS INSIDE-A-MERCHANTLANE PRINFORMS ((2 " is " (MODIFIER)
                                              "inside a merchantlane" T)
                                           (" is " (MODIFIER)
```

```
                                                    "inside a merchantlane"
                                                          T)))

(PUTPROPS MERCHANTLANE PRINFORMS ((2 " is " (MODIFIER)
                                        "a merchant lane" T)
                                   (" the merchantlane " 2 T)))

(PUTPROPS IN-LANE PRINFORMS ((3 " is " (MODIFIER)
                                   "in the merchantlane " 2 T)
                              (" is " (MODIFIER)
                                   "in the merchantlane " 2 T)))

(PUTPROPS SUCCESSOR PRINFORMS ((3 " is " (MODIFIER)
                                     "the successor (in time) of " 2 T)))

(PUTPROPS COURSE PRINFORMS ((3 " is " (MODIFIER)
                                  "the course of " 2 T)
                            (3 " is " (MODIFIER)
                                  "the course of ")))

(PUTPROPS ROUGHLY-THE-SAME-COURSE-AS PRINFORMS ((3 " is " (MODIFIER)

                                       "roughly the same course as "
                                                          2 T)))

(PUTPROPS ROUGHLY-THE-SAME-SPEED-AS PRINFORMS ((3 " is " (MODIFIER)

                                        "roughly the same speed as "
                                                          2 T)))

(PUTPROPS ID PRINFORMS ((2 " is " (MODIFIER)
                           3 T)))

(PUTPROPS ID-AMPLIFY PRINFORMS ((2 " is " (MODIFIER)
                                   3 T)))

(PUTPROPS LOCATION PRINFORMS (("The location of " 2 " is " (MODIFIER)
                                                          3 T)))

(PUTPROPS TO-PORT PRINFORMS ((3 " is " (MODIFIER)
                                "the destination port of " 2 T)))

(PUTPROPS FROM-PORT PRINFORMS ((3 " is " (MODIFIER)
                                  "the starting port of " 2 T)))

(PUTPROPS SAME-AS PRINFORMS ((2 " is " (MODIFIER)
                                "the same as " 3 T)))

(PUTPROPS PATROL PRINFORMS ((2 " is " (MODIFIER)
                               "a patrol" T)))

(PUTPROPS POSSIBLE-REPORT PRINFORMS (("One of the reports from " 3
                                                        " concerns "
                                                              2 T)))

(PUTPROPS CROSSPATHS PRINFORMS (("The path from " 2 " to " 3 T " does "
```

```
                                                    (MODIFIER)

                                                "cross the path from "
                                                    T 4 " to " 5 T)))

(PUTPROPS GRAZE PRINFORMS (("The path from " 2 " to " 3 T " does "
                                                (MODIFIER)
                                                "graze the path from" T 4
                                                " to "
                                                5 T)))

(PUTPROPS WENT-BEFORE PRINFORMS (("A ship moving from " 4 " to " 2 T
                                                 " between the times "
                                                        5 " and " 3 T
                                                        "could "
                                                        (MODIFIER)

                "have avoided sighting by a patrol travelling
from "
                                                        T 6 " to " 8
                                                        " between "
                                                        7 " and " 9
        "
by traversing the patrol viewing area before the flight"
                                                        T)))

(PUTPROPS WENT-AFTER PRINFORMS (("A ship moving from " 4 " to " 2 T
                                                " between the times "
                                                       5 " and " 3 T
                                                       "could "
                                                       (MODIFIER)

                "have avoided sighting by a patrol travelling
from "
                                                       T 6 " to " 8
                                                       " between "
                                                       7 " and " 9 T
          "by traversing the patrol viewing area after the flight"
                                                       T)))

(PUTPROPS BLOCKED-FROM PRINFORMS (("A passage from " 2 " to " 3 " is "
                                                     (MODIFIER)
                                                     "counterindicated"
                                                     T)))

(PUTPROPS DISSIMILAR PRINFORMS ((2 " is " (MODIFIER)
                                    "dissimilar to " 3 T)))

(PUTPROPS SWR PRINFORMS (("A ship at " 2 " at time " 3 " could " T
                                      (MODIFIER)
                                      "reach " 4 " at time " 5 T
                            " by travelling at top speed (or less)"
                                      T)))

(PUTPROPS SIMPLY-WITHIN-REACH PRINFORMS ((2 " is " (MODIFIER)

                                      "within travel distance of "
```

```
                                                3 T)))

(PUTPROPS WITHIN-REACH PRINFORMS ((2 " is " (MODIFIER)
                                    "reachable from " 3 T
                          "even considering possible patrol overflights"
                                    T)))

(PUTPROPS NOT-FIRST PRINFORMS ((2 " is " (MODIFIER)

                           "other than a first sighting of its platform"
                                 T)))

(PUTPROPS NOT-LAST PRINFORMS ((2 " is " (MODIFIER)

                            "other than a last sighting of its platform"
                                  T)))

(PUTPROPS ALIAS PRINFORMS ((3 " is " (MODIFIER)
                                 "really " 2 T)))

(PUTPROPS COURSEFROM PRINFORMS (("The course from " 2 " to " 3 " is "
                                                    (MODIFIER)
                                                    4 T)))

(PUTPROPS SPEEDFROM PRINFORMS (("To move from " 2 " to " 4 T "between "
                                                    3 " and " 5
                                              " implies a speed of "
                                                    6 T)))

(RPAQQ STATES (<EXPLTREE> <PLATIS> <VALIS> <ATTIS> <TYPIS> <IDIS>
        <IDAMPIS> <WHATFORM> <WHOSE2FORM> <WHOSEFORM> <TELLABT>
        <WHEREFORM> <WHEREITEM> <WHAT2FORM> <TYPE2> <ID2> <IDAMP2>
        <OCCURNUM> <OTHER2>))

(PUTPROPS <EXPLTREE> QHPRODS ((Q "-uit" : (PROGN (TERPRI)
                                                 (PRIN1
                                                  "Leaving EXPLAIN")
                                                 (TERPRI)
                                                 (SETQ DONEFLG T)))
                              (SAVE "memory" : (PROGN (TERPRI)
                                                      (PRIN1
                                                        "On file: ")
                                                      (MEMSAVE
                                                        (READ))
                                                      (CLEARBUF)
                                                      (TERPRI)))
                              (NEW "rule" : (PROGN (TERPRI)
                                                   (DEFINEPD)
                                                   (APPLYRULE
                                                     (CAR PRODUCTIONS))
                                                   (CLEARBUF)
                                                   (TERPRI)))
                              (CHANGE "confidence in the rule"
                                      !RULENAME (= RN)
                                      :
                                      (CHANGECON RN))
                              (BREAK : (PROGN (BREAK1 NIL T Explain)
```

```
                                        (TERPRI)
                                        (CLEARBUF)))
                                [DISPLAY : (COND (DSPLAYFLG (DSPTOP))
                                                 (T (TERPRI)
                                                    (PRIN1
                                "Sorry, but the display is not enabled.")
                                                 (TERPRI]
                                (IS (<PLATIS> <VALIS> <ATTIS>))
                                (WHY "is" !ASSERTION (= NODE)
                                     :
                                     (IMPLIESASRT NODE))
                                (HOW "does rule" !RULE (= RUL)
                                     "apply to " !ASSERTION (= NODE)
                                     :
                                     (RULEXP RUL NODE))
                                (WHAT (IS ARE)
                                      <WHAT2FORM>
                                      (= WHATANS)
                                      :
                                      (PRETTYANS WHATANS))
                                (WHOSE <WHOSEFORM> (= WHOSEANS)
                                       :
                                       (PRETTYANS WHOSEANS))
                                (TELL "me about" <TELLABT>)
                                (HELP : (HLPEXPLN))
                                (WHERE <WHEREFORM>)
                                (WHO "is" (~ A)
                                     (<TYPE2> <ID2> <IDAMP2> <OTHER2>))
                                (REPORT : (RECAPCONCS))))

(PUTPROPS <PLATIS> QHPRODS [(!PLATFORM (= PLAT)
                                       (~ A AN)
                                       (<TYPIS> <IDIS> <IDAMPIS>)
                                       (= WHAF)
                                       :
                                       (YESNO (JUGGLE WHAF PLAT])

(PUTPROPS <VALIS> QHPRODS [(<WHOSE2FORM> !WHOSE2RES (= VAL58)
                                :
                                (YESNO (JUGGLF WHOSE2RES2 VAL58])

(PUTPROPS <ATTIS> QHPRODS [(<WHATFORM> !WHATRES (= VAL57)
                                :
                                (YESNO (APPEND WHATRES2 (CONS VAL57])

(PUTPROPS <TYPIS> QHPRODS ((!TYPE (= TYPEN)
                                  :
                                  (LIST (QUOTE TYPE)
                                        TYPEN))))

(PUTPROPS <IDIS> QHPRODS ((!ID (= IDN)
                               :
                               (LIST (QUOTE ID)
                                     IDN))))

(PUTPROPS <IDAMPIS> QHPRODS ((!ID-AMP (= IDA)
                                      :
```

```
                                        (LIST (QUOTE ID-AMPLIFY)
                                              IDA))))

(PUTPROPS <WHATFORM> QHPRODS ((THE !RELATION (= RELNM)
                                   "OF" !OBJECT (= OBJ)
                                   :
                                   (WHATFORMFN RELNM OBJ))))

(PUTPROPS <WHOSE2FORM> QHPRODS ((!VALUE (= VAL59)
                                        (A AN THE a an the)
                                        !RELATION
                                        (= RELN4)
                                        :
                                        (WHOSE2FORMFN VAL59 RELN4))))

(PUTPROPS <WHOSEFORM> QHPRODS ((!RELATION (= RELNE)
                                          "is" !VALUE (= VAL61)
                                          :
                                          (WHOSE2FORMFN VAL61 RELNE))))

(PUTPROPS <TELLABT> QHPRODS [[(!RELATION !OBJECT !VALUE)
            (= ITEMN)
            :
            (PROG (ISONE)
                  (TERPRI)
                  [MAPC ASSERTIONS (FUNCTION (LAMBDA
                                               (X)
                                               (COND
                                                 ((MEMB ITEMN
                                                        (GETUPLE X))
                                                  (PRETTYASSR X)
                                                  (SETQ ISONE T]
                  (COND ((NOT ISONE)
                         (PRIN1 "No information about that.")
                         (TERPRI]
           (!RULENAME (= RUNM)
                      :
                      (PROGN (TERPRI)
                             (FANCYPROD RUNM])

(PUTPROPS <WHEREFORM> QHPRODS [(IS <WHEREITEM>)
           (WAS !PLATFORM (= PLNM)
                "at time" : (PROG (TME)
                                  (SETQ TME (READ))
                                  (CLEARBUF)
                                  (TERPRI)
                                  (SETQ EXPLAINFLAG T)
                                  (PRIN1 (PLATPOS PLNM TME))
                                  (SETQ EXPLAINFLAG NIL)
                                  [COND (DSPLAYFLG (TERPRI)
                                                   (PRIN1
                                                     "Also, see the display.")
                                                   (TERPRI)
                                                   (WAITER)
                                                   (DSPCMD
                                                     (CONCAT "PTR "
                                                             PLNM]
```

```
                                    (TERPRI])

(PUTPROPS <WHEREITEM> QHPRODS [(!PLATFORM
              (= PLTNM)
              :
              (PROGN (TERPRI)
                     (SETQ EXPLAINFLAG T)
                     (PRIN1 (PLATPOS PLTNM CURTIME))
                     (SETQ EXPLAINFLAG NIL)
                     [COND (DSPLAYFLG (TERPRI)
                                      (PRIN1 "Also, see the display.")
                                      (TERPRI)
                                      (WAITER)
                                      (DSPCMD (CONCAT "PTR " PLTNM]
                     (TERPRI)))
             ((!MLANE !STORM)
              (= LANM)
              :
              (PROGN (TERPRI)
                     [PRIN1 (CDADAR (RETRIEVER (LIST (QUOTE LOCATION)
                                                     LANM
                                                     (QUOTE *LOC]
                     [COND (DSPLAYFLG (TERPRI)
                                      (PRIN1 "Also, see the display.")
                                      (TERPRI)
                                      (WAITER)
                                      (DSPCMD (CONCAT "PTR " LANM]
                     (TERPRI])

(PUTPROPS <WHAT2FORM> QHPRODS ((<WHATFORM>)
                               (!PLATFORM (= PA)
                                          :
                                          (WHAT2FORMFN PA))))

(PUTPROPS <TYPE2> QHPRODS [(!TYPE (= TYP)
                                  :
                                  (PRETTYANS
                                    (RETRIEVER (LIST (QUOTE TYPE)
                                                     (QUOTE *WHO)
                                                     TYP])

(PUTPROPS <ID2> QHPRODS [(!ID (= IDB)
                              :
                              (PRETTYANS (RETRIEVER
                                           (LIST (QUOTE ID)
                                                 (QUOTE *WHO)
                                                 IDB])

(PUTPROPS <IDAMP2> QHPRODS [(!ID-AMP (= IDM)
                                     :
                                     (PRETTYANS
                                       (RETRIEVER (LIST (QUOTE
                                                         ID-AMPLIFY)
                                                        (QUOTE *WHO)
                                                        IDM])

(PUTPROPS <OCCURNUM> QHPRODS ((!SMALLNUMB (= TIMES)
```

```
                                                :
                                               (OCCURPRINT TIMES NODE))))

(PUTPROPS <OTHER2> QHPRODS [(!RELATION
            (= RM)
            :
            (PRETTYANS (APPEND (RETRIEVER (LIST RM (QUOTE *WHO)))
                               (RETRIEVER (LIST RM (QUOTE *WHO)
                                                   (QUOTE *IGN])

(RPAQQ NEWEXPFNS (ASSRPRINT CHANGECON EXPLAIN GAMF HLPEXPLN IMPLIESASRT
                            JUGGLE MAKEPRINT MEMSAVE MODIFIER NEWVALOBJ
                            NICEANSWER OCCURPRINT PRETTYANS PRETTYASSR
                            PRINTRULEASSR RECAPCONCS RESOUT
                            RESULTPRINTER RULEXP WHAT2FORMFN WHATFORMFN
                            WHOSE2FORMFN YESNO DSPEXP))
(DEFINEQ
```

[148]

```
(ASSRPRINT
  [LAMBDA (PRINSPEC)                                    (* edited:
                                                        "24-Aug-79 12:46")

          (* This is the workhorse of the assertion
          prettyprinter. It receives a PRINFORM as an
          argument, and prints in accordance with what is
          found there. Strings are printed as found.
          Numbers refer to "slots" in the GETUPLE of the
          assertion in question. Lists
          (assumed to be functions) are evaluated and must do
          their own printing. T causes a TERPRI.)


     (COND
       ((STRINGP PRINSPEC)
         (PRIN1 PRINSPEC))
       [(NUMBERP PRINSPEC)
         (PRIN1 (CAR (NTH BODY PRINSPEC]
       ((AND (LISTP PRINSPEC)
             (OR (NULL LSTFLG)
                 OVERCONF))
         (EVAL PRINSPEC))
       ((EQ PRINSPEC T)
         (PRIN1 ".")
         (TERPRI])
```

[149]

```
(CHANGECON
  [LAMBDA (RLNME1)                                      (* edited:
                                                        " 7-Aug-79 08:19")

          (* Allows the user to change the confidence in the
          rule that is its argument. This change, while
          permanent for that invocation of STAMMER
          (until CHANGECON is called again), does not affect
```

```
        future invocations unless the rules are saved
        (by doing MAKEFILE (RULES)). The changed confidence
        IS reflected in all inferences done before the
        CHANGECON, due to the dynamic calulation of
        confidence.)


    (TERPRI)
    (PRIN1 " Present confidence is: ")
    (PRIN1 (GETPROP RLNME1 (QUOTE CONF)))
    (TERPRI)
    (PRIN1 " Confidence should be: ")
    (PUTPROP RLNME1 (QUOTE CONF)
             (READ))
    (CLEARBUF)
    (TERPRI])
```

[150]

```
(EXPLAIN
  [LAMBDA NIL                                        (* edited:
                                                     "24-Aug-79 17:55")

        (* The top level of the explanation system.
        Most of this function is initialization of variables
        used by the explanation productions.
        The most notable feature is the use of ERSETQ to
        allow the user to escape back to the top level of
        explanation via control-E if and when he/she gets
        totally lost.)


    (PROG (DONEFLG [PLATFORM (CONS (QUOTE CONNOLE)
                                   (RETRIEVES (QUOTE PLATFORM)
                                              (QUOTE *]
                   (MLANE (RETRIEVES (QUOTE MERCHANTLANE)
                                     (QUOTE *)))
                   (STORM (RETRIEVES (QUOTE STORM)
                                     (QUOTE *)))
                   (ID (QUOTE (FRIEND HOSTILE UNKNOWN)))
                   (ID-AMP (QUOTE (NON-MIL MIL-BATTLE MIL-AUXIL UNKNOWN)
                                  ))
                   (TYPE (QUOTE (CARRIER CRUISER DESTROYER FRIGATE
                                         AMPHIB-ASSAULT AMPHIB-DOCK
                                         PATROL-BOAT MINELAYER
                                         MINESWEEPER LANDING SUB OILER
                                         AMMUNITION STORES
                                         DESTROYER-TENDER SUB-TENDER
                                         BUOY-TENDER
                                         PATROL-CRAFT-TENDER REPAIR
                                         RESEARCH INTELLIGENCE TUG
                                         MERCHANT FISHING PASSENGER
                                         PLEASURE MISCELLANEOUS BOMBER
                                         FIGHTER RECONNISANCE)))
                   VALUE OBJECT)
          (SETQ RULENAME PRODUCTIONS)
          (SETQ RELATION RELATIONS)
```

```
        (MAPC ASSERTIONS (FUNCTION NEWVALOBJ))
      LOOP(OR (ERSETQ (QHTAKE "Question? " <EXPLTREE>))
              (GO LOOP))
          (COND
            (DONEFLG (RETURN))
            (T (GO LOOP])
```

[151]

```
(GAMF
  [LAMBDA (WLK OVERRIDE)                                (* edited:
                                                        " 8-Aug-79 19:49")
    (PROG (CONFI ACON)

          (* GAMF generates an appropriate modifier for an
          assertion based on the confidence of the assertion.)


          (SETQ CONFI (OR OVERRIDE (GETCON WLK)))
          (SETQ ACON (ABS CONFI))
          (COND
            ((EQP ACON 1.0))
            ((FGREATERP ACON .98)
              (PRIN1 "definitely "))
            ((FGREATERP ACON .9)
              (PRIN1 "almost certainly "))
            ((FGREATERP ACON .7)
              (PRIN1 "very probably "))
            ((FGREATERP ACON .45)
              (PRIN1 "probably "))
            ((EQP ACON 0.0)
              (PRIN1 "not known to be ")
              (RETURN))
            (T (PRIN1 "somewhat ")
               (COND
                 ((FLESSP CONFI 0.0)
                   (PRIN1 "un")))
               (PRIN1 "likely to be ")
               (RETURN)))
          (COND
            ((FLESSP CONFI 0.0)
              (PRIN1 "not "])
```

[152]

```
(HLPEXPLN
  [LAMBDA NIL                                           (* edited:
                                                        "24-Jul-79 18:56")
    (PRIN1 "Sorry, no help yet.")
    (TERPRI])
```

[153]

```
(IMPLIESASRT
  [LAMBDA (NODE)                                        (* edited:
                                                        "17-Aug-79 14:14")
    (PROG (X)
```

```
          (TERPRI)
          (COND
            ((GETPROP NODE (QUOTE TDB))
              (PRIN1
                "That assertion is part of the technical data base")
              (TERPRI)
              (RETURN))
            (T))
          (SETQ X (GETPROP NODE (QUOTE DERIVE*)))
          (COND
            ((AND (NULL X)                                          |
                  (EQP (GETCON NODE)                                |
                       0))                                          |
              (PRIN1 "Assertion based on the absence of information")|
              (TERPRI))                                             |
            ((GETPROP (CAR (GETUPLE NODE))                          |
                      (QUOTE ORACLE))                               |
              (PRIN1 "That assertion was computed by the oracle ")  |
              (PRIN1 (CAR (GETUPLE NODE)))                          |
              (TERPRI))                                             |
            (X (PRIN1 "STAMMER applied the rule(s)")
               (TERPRI)
               [MAPC X
                     (FUNCTION (LAMBDA (Y)
                         (PROGN [COND
                                  ((MEMBER (CAR Y)
                                           RULE))
                                  (T (SETQ RULE
                                       (APPEND (LIST (CAR Y))
                                               RULE]
                                (PRIN1 (CAR Y))
                                (SPACES 1]
               (TERPRI))
            (T (PRIN1 "The information came directly from a message.")
               (TERPRI]))
```

[154]

```
(JUGGLE
  [LAMBDA (PAIR INSERTITEM)                          (* edited:
                                                     " 7-Aug-79 08:24")

          (* JUGGLE return a three element list constructed by
          placing INSERTITEM between the elements of PAIR.
          It's non-destructive, and costs due to
          (possibly unnecessary) copying.)


    (LIST (CAR PAIR)
          INSERTITEM
          (CADR PAIR])
```

[155]

```
(MAKEPRINT
  [LAMBDA (RELN)                                     (* edited:
                                                     " 7-Aug-79 08:28")
```

```
        (* MAKEPRINT is provided as an assistance in
        creating PRINFORMS. Given a relation name, MAKEPRINT
        prompts for new PRINFORMS, after printing the
        existing forms, if any. To terminate addition, type
        STOP.)


    (PROG (PFORM NEWFORM)
      MP1 (PRIN1 "For the relation ")
          (PRIN1 RELN)
          (TERPRI)
          (PRIN1 "use the prinforms ")
          (SETQ PFORM (GETPROP RELN (QUOTE PRINFORMS)))
          [COND
            (PFORM (MAPC PFORM (FUNCTION (LAMBDA (X)
                                 (TERPRI)
                                 (SPACES 3)
                                 (PRIN1 X]
      MPLP(TERPRI)
          (SPACES 3)
          (SETQ NEWFORM (READ))
          (COND
            ((EQ NEWFORM (QUOTE STOP))
              (GO EXLOOP)))
          (SETQ PFORM (APPEND PFORM (CONS NEWFORM)))
          (GO MPLP)
      EXLOOP
          (PUTPROP RELN (QUOTE PRINFORMS)
                   PFORM)
          (TERPRI])
```

[156]

```
(MEMSAVE
  [LAMBDA (FEE)                                    (* edited:
                                                   " 7-Aug-79 08:30")

        (* MEMSAVE saves the contents of memory
        (exclusive of stream suspensions) on a user
        specified file. This is made simple since memory can
        be set up completely through standard fileCOMS,
        which are assigned to the user file name.)


    (SET (FILECOMS FEE)
         MEMORYCOMS)
    (MAKEFILE FEE)
    (TERPRI)
    (PRIN1 "Memory saved.")
    (TERPRI)
    (CLEARBUF])
```

[157]

```
(MODIFIER
  [LAMBDA NIL                                          (* edited:
                                                       "22-Aug-79 20:04")

        (* MODIFIER provides a way for GAMF to be used in
        PRINFORMs while allowing the user to remain
        blissfully unaware of how to refer to the node he's
        describing. Since NODE is used freely here, MODIFIER
        should ONLY be used in PRINFORMs, never as a
        standard function call.)


    (PROG (CON)
          (GAMF NODE OVERCONF)
          (COND
            ([AND (NOT OVERCONF)
                  (NOT (MEMBER (SETQ CON (GETCON NODE))
                               (QUOTE (1.0 0.0 -1.0]
              (PRIN1 "(")
              (PRIN1 (TWO-PLACE CON))
              (PRIN1 ") "])
```

[158]

```
(NEWVALOBJ
  [LAMBDA (ARRT)                                       (* edited:
                                                       "24-Aug-79 12:26")

        (* This function sets up lists of object and value
        slot fillers that are presently used in memory.
        These lists are then used by the explanation system
        productions. In a standard TWOARG assertion, the
        format of the assertion is (REL OBJ VAL).)


    (PROG (VL OJ TUPLE)
          (COND
            ((LESSP (LENGTH (SETQ TUPLE (GETUPLE ARRT)))
                    3)
              (RETURN)))
          (SETQ VL (CADDR TUPLE))
          (SETQ OJ (CADR TUPLE))
          [COND
            ((LISTP VL))
            ((NUMBERP VL))
            ((MEMB VL VALUE))
            (T (SETQ VALUE (CONS VL VALUE]
          (COND
            ((LISTP OJ))
            ((NUMBERP OJ))
            ((MEMB OJ OBJECT))
            (T (SETQ OBJECT (CONS OJ OBJECT])
```

[159]

```
(NICEANSWER
  [LAMBDA (ANS1)                                        (* edited:
                                                        " 7-Aug-79 08:38")

          (* Ocassionally, you don't want to print a whole
          assertion, but rather just a value or object, but
          with a confidence indicator attached.
          NICEANSWER does this. It assumes that its argument
          is a single element of a RETRIEVER answer.)


    (GAMF (CAR ANS1))
    (PRIN1 (CDADR ANS1))
    (TERPRI])
```

[160]

```
(OCCURPRINT
  [LAMBDA (TIMES NODE)                                  (* edited:
                                                        "24-Aug-79 17:54")
    (PROG (X Z)
          (SETQ X (GETPROP NODE (QUOTE DERIVE*)))
          [for Y in X UNTIL (ZEROP TIMES)
             do (COND
                  ((EQUAL (CAR Y)
                          RULE)
                    (SETQ TIMES (SUB1 TIMES))
                    (SETQ Z Y]
          (PRINTRULEASSR Z)
          (QHTAKE "Another occurrence?" (!carriagereturn <OCCURNUM>])
```

[161]

```
(PRETTYANS
  [LAMBDA (ANSLST)                                      (* edited:
                                                        " 7-Aug-79 08:39")

          (* PRETTYANS gets whatever RETRIEVER returns and
          uses NICEANSWER to print the results, if any.
          If there are no results, PRETTYANS admits
          ignorance.)


    (TERPRI)
    (COND
      ((NULL ANSLST)
        (PRIN1 "I don't know.")
        (TERPRI))
      (T (MAPC ANSLST (FUNCTION NICEANSWER])
```

[162]

```
(PRETTYASSR
  [LAMBDA (NODE FORMAT OVERCONF)                        (* edited:
                                                        "24-Aug-79 12:45")
```

```
        (* PRETTYASSR is the assertion prettyprinter.
        Every relation is assumed to have a list of
        PRINFORMs on its property list that will be used to
        guide the printing of assertions with that relation.
        PRETTYASSR is called on an assertion with a selector
        as to which PRINFORM to use.
        The default PRINFORM is the first.
        If there are no PRINFORMs stored, defaults are used,
        but their beauty is not guaranteed.)


    (PROG (BODY FORMLST USEFORM LSTFLG)
          [COND
            ((LISTP NODE)
              (SETQ LSTFLG T)
              (SETQ BODY NODE))
            (T (PRIN1 NODE)
               (PRIN1 ": ")
               [COND
                 ((MEMB NODE ASSERTION))
                 (T (SETQ ASSERTION (CONS NODE ASSERTION]
               (SETQ BODY (EVAL NODE]
          (COND
            ((NULL FORMAT)
              (SETQ FORMAT 1)))
          (SETQ FORMLST (GETPROP (CAR BODY)
                                 (QUOTE PRINFORMS)))
          (COND
            ((GREATERP FORMAT (LENGTH FORMLST))
              (SETQ FORMAT 1)))
          [COND
            [(NULL FORMLST)
              (SELECTQ (LENGTH BODY)
                       [2 (SETQ USEFORM (QUOTE (2 " is " (MODIFIER)     |
                                                  " a " 1 T]            |
                       [3 (SETQ USEFORM (QUOTE (3 " is " (MODIFIER)     |
                                                  " a " 1 " of " 2 T]   |
                       (SETQ USEFORM (FOR I FROM 1 TO (LENGTH BODY)
                                          COLLECT I]
            (T (SETQ USEFORM (CAR (NTH FORMLST FORMAT]
          (MAPC USEFORM (FUNCTION ASSRPRINT])
```

[163]

```
(PRINTRULEASSR
  [LAMBDA (RULEASSRTS)                                  (* edited:
                                                        "17-Aug-79 13:24")
    (TERPRI)
    (COND
      [RULEASSRTS (PRIN1 "The rule was applied with the assertions")
                  (TERPRI)
                  [for Y in (CDR RULEASSRTS)
                     do (TERPRI)
                        (COND
                          [(ATOM Y)
                            (COND
```

```
                                ((FLESSP 0 (GETCON Y))
                                  (PRETTYASSR Y))
                                (T (PRETTYASSR Y NIL .4)
                                   (TAB 7)
                                   (PRIN1 "(condition is no longer true)")
                                   (TERPRI]
                            (T (COND                                        |
                                 [(EQ (CAR Y)                               |
                                      (QUOTE NOT))                          |
                                    (COND                                   |
                                      ((FLESSP (GETCON (CADR Y))            |
                                               0)                           |
                                        (PRETTYASSR (CADR Y)))              |
                                      (T (PRETTYASSR (CADR Y)               |
                                                     NIL -.4)               |
                                         (TAB 7)                            |
                                         (PRIN1 "(no longer valid)")        |
                                         (TERPRI]                           |
                                  ((EQ (CAR Y)                              |
                                       (QUOTE UNLESS))                      |
                                    (COND                                   |
                                      ((FLESSP 0 (GETCON (CADR Y)))         |
                                        (PRETTASSR (CADR Y)                 |
                                                   NIL 0.0)                 |
                                        (TAB 7)                             |
                                        (PRIN1 "(no longer valid)")         |
                                        (TERPRI))                           |
                                      (T (PRETTYASSR (CADR Y]               |
                    (COND
                      ((AND DSPLAYFLG (DSPEXP RULEASSRTS))
                        (TERPRI)
                        (PRIN1 "Also, see the display.")
                        (TERPRI)
                        (WAITER)
                        (DSPCMD (DSPEXP RULEASSRTS)))
                      (T (TERPRI]
        (T (PRIN1 "The rule was not applied to derive that assertion")
           (TERPRI])
```

[164]

```
(RECAPCONCS
  [LAMBDA NIL                                   (* edited:
                                                " 3-Aug-79 14:07")

    (TERPRI)
    (TERPRI)
    (MAPC ASSERTION (FUNCTION PRETTYASSR])
```

[165]

```
(RESOUT
  [LAMBDA NIL                                   (* edited:
                                                " 7-Aug-79 07:49")

        (* RESOUT causes the results of rule firings to be
        printed at the user's terminal, using the function
        RESULTPRINTER. First, it removes duplications of
```

```
          conclusions (so a single conclusion is printed only
          once).)


    (SETQ RESULTLIST (INTERSECTION RESULTLIST RESULTLIST))
    (MAPC RESULTLIST (FUNCTION RESULTPRINTER))
    (SETQ RESULTLIST NIL])
```

[166]

```
(RESULTPRINTER
  [LAMBDA (RES1)                                    (* edited:
                                                    "17-Aug-79 17:22")

          (* Results can either be a report, in which case a
          report flag is printed and then the report itself is
          printed (literally), or assertions, which are
          handled by the assertion prettyprinter.)


    (COND
      ((LISTP RES1)
        (PRIN1 "Report: ")
        (MAPC (CDR RES1)
              (FUNCTION PRIN1))
        (TERPRI))
      ((NOT (MEMB (CAR (GETUPLE RES1))                                    |
                  DULLREL))                                               |
        (PRETTYASSR RES1])
```

[167]

```
(RULEXP
  [LAMBDA (RULE NODE)                               (* edited:
                                                    " 9-Aug-79 11:49")
    (PROG (X Z COUNT)
          (COND                                                           |
            ((GETPROP RULE (QUOTE ORACLE))                                |
              (PRIN1 "That assertion was computed by an oracle")          |
              (TERPRI)                                                    |
              (RETURN))                                                   |
            ((GETPROP NODE (QUOTE TDB))                                   |
              (PRIN1 "That assertion came from the
technical data base")                                                     |
              (TERPRI)                                                    |
              (RETURN))                                                   |
            (T))                                                          |
          (SETQ X (GETPROP NODE (QUOTE DERIVE*)))
          (COND
            ((NULL X)
              (PRIN1 "That assertion came from a message.")
              (TERPRI)
              (RETURN)))
          (SETQ COUNT 2)
          [for Y in X until (ZEROP COUNT)
             do (COND
                  ((EQUAL (CAR Y)
```

```
                        RULE)
                  (SETQ COUNT (SUB1 COUNT))
                  (SETQ Z Y]
          (COND
            ((EQUAL COUNT 1)
              (PRINTRULEASSR Z))
            ((ZEROP COUNT)
              (TERPRI)
              (QHTAKE "Which occurrence?" <OCCURNUM>))
            (T (PRIN1
                 "The rule was not applied to derive that assertion")
               (TERPRI])
```

[168]

```
(WHAT2FORMFN
  [LAMBDA (PL)                                          (* edited:
                                                        " 7-Aug-79 08:48")

          (* This function collects answers to the question
          "what is <some platform>" by looking in the memory
          for the things a platform can be.)


    (APPEND (RETRIEVER (LIST (QUOTE ID)
                             PL
                             (QUOTE *WHA)))
            (RETRIEVER (LIST (QUOTE ID-AMPLIFY)
                             PL
                             (QUOTE *WHA)))
            (RETRIEVER (LIST (QUOTE TYPE)
                             PL
                             (QUOTE *WHA)))
            (RETRIEVER (LIST (QUOTE CLASS)
                             PL
                             (QUOTE *WHA])
```

[169]

```
(WHATFORMFN
  [LAMBDA (REL OBJ)                                     (* edited:
                                                        " 7-Aug-79 08:50")
                                                        (* This generates
                                                        answers to the other
                                                        form of WHAT questions,
                                                        e.g.
                                                        "what is the rel of obj?"
)
    (PROG (ANS)
          [SETQ ANS (RETRIEVER (LIST REL OBJ (QUOTE *VAL]
          (SETQ WHATRES2 (LIST REL OBJ))
          (SETQ WHATRES (MAPCAR ANS (FUNCTION CDADR)))
          (RETURN ANS])
```

[170]

```
(WHOSE2FORMFN
  [LAMBDA (VAL REL)                                    (* edited:
                                                       " 7-Aug-79 08:51")
                                                       (* For getting answers
                                                       to the question
                                                       "whose rel is val?")
    (PROG (ANS)
          (SETQ ANS (RETRIEVER (LIST REL (QUOTE *WHO)
                                     VAL)))
          (SETQ WHOSE2RES2 (LIST REL VAL))
          (SETQ WHOSE2RES (MAPCAR ANS (FUNCTION CDADR)))
          (RETURN ANS])
```

[171]

```
(YESNO
  [LAMBDA (ASSRSPEC)                                   (* edited:
                                                       " 7-Aug-79 08:52")

          (* If you don't want to print an entire assertion or
          even a part, but just want to answer yes, no, or
          some confidence modifier (like in response to "is"
          questions).)


    (PROG ((NDE (CAR (GETSTRIP ASSRSPEC)))
           NDECON)
          (TERPRI)
          (SETQ NDECON (GETCON NDE))
          (COND
            ((EQP NDECON 1.0)
              (PRIN1 "Yes"))
            ((EQP NDECON -1.0)
              (PRIN1 "No"))
            ((EQP NDECON 0.0)
              (PRIN1 "I don't know"))
            (T (PRIN1 "It's ")
               (GAMF NDE)))
          (TERPRI])
```

[172]

```
(DSPEXP
  [LAMBDA (BOX)                                        (* edited:
                                                       " 8-Aug-79 15:47")
    (PROG ((DSPOBJECTS (QUOTE (PLATFORM CONTACT STORM MERCHANTLANE
                                        OWNSHIP)))
           (DSPLST (CONS (QUOTE PTR)))
           (BLANK " ")
           (COMMA ",")
           (COUNT 0))
          [for X in (CDR BOX)
             do [COND
                  ((LISTP X)
                    (SETQ X (CADR X]            (* To deal with UNLESS's
```

```
                                                    etc.)
                    (SETQ X (GETUPLE X))
                    (COND
                      ((OR (MEMB (CAR X)
                                 DSPOBJECTS)
                           (EQ (CAR X)
                               (QUOTE RANGE)))
                        (SETQ DSPLST (CONS (COND
                                             ((ZEROP COUNT)
                                               BLANK)
                                             (T COMMA))
                                           DSPLST))
                        (SETQ DSPLST (CONS (COND
                                             ((EQ (CAR X)
                                                  (QUOTE RANGE))
                                               OWNSHIP)
                                             (T (CADR X)))
                                           DSPLST))
                        (SETQ COUNT (ADD1 COUNT]
              (COND
                ((IGREATERP COUNT 1)
                  (RETURN (APPLY (FUNCTION CONCAT)
                                 (DREVERSE DSPLST])
)
(LOAD (QUOTE QH.COM))
(DECLARE: DONTCOPY
  (FILEMAP (NIL (14818 33280 (ASSRPRINT 14830 . 15593) (CHANGECON 15597 .
16372) (EXPLAIN 16376 . 17885) (GAMF 17889 . 18799) (HLPEXPLN 18803 .
18949) (IMPLIESASRT 18953 . 20137) (JUGGLE 20141 . 20493) (MAKEPRINT
20497 . 21474) (MEMSAVE 21478 . 21971) (MODIFIER 21975 . 22724) (
NEWVALOBJ 22728 . 23634) (NICEANSWER 23638 . 24068) (OCCURPRINT 24072 .
24481) (PRETTYANS 24485 . 24893) (PRETTYASSR 24897 . 26379) (
PRINTRULEASSR 26383 . 27895) (RECAPCONCS 27899 . 28069) (RESOUT 28073 .
28551) (RESULTPRINTER 28555 . 29089) (RULEXP 29093 . 30225) (WHAT2FORMFN
 30229 . 30790) (WHATFORMFN 30794 . 31269) (WHOSE2FORMFN 31273 . 31714)
(YESNO 31718 . 32358) (DSPEXP 32362 . 33277)))))
STOP
```

```
(FILECREATED " 8-Aug-79 09:11:09" <DKIBLER>ORACLE.LSP.40 25437

     changes to:  SPEEDM

     previous date: " 7-Aug-79 17:55:13" <DKIBLER>ORACLE.LSP.39)


(PRETTYCOMPRINT ORACLECOMS)

(RPAQQ ORACLECOMS [(VARS * ORACLEVARS)
                   (IFPROP (ORACLE ORTYPE)
                           * ORACLES)
                   (FNS * ORACLEFNS)
                   (DECLARE: DONTEVAL@LOAD DOEVAL@COMPILE DONTCOPY
                             COMPILERVARS (ADDVARS (NLAMA WITHINR)
                                                   (NLAML)
                                                   (LAMA])

(RPAQQ ORACLEVARS (ORACLES MAXSHIPSPEED))

(RPAQQ ORACLES (SAME-AS ROUGHLY-THE-SAME-SPEED-AS
                        ROUGHLY-THE-SAME-COURSE-AS IN-LANE INSIDE
                        GREATER-THAN LESS-THAN CROSSPATHS GRAZE SWR
                        WENT-AFTER WENT-BEFORE SUCCESSOR PREDECESSOR
                        RANGE BEARING COURSE SPEED COURSEFROM SPEEDFROM)
)

(RPAQQ MAXSHIPSPEED 35)

(RPAQQ ORACLES (SAME-AS ROUGHLY-THE-SAME-SPEED-AS
                        ROUGHLY-THE-SAME-COURSE-AS IN-LANE INSIDE
                        GREATER-THAN LESS-THAN CROSSPATHS GRAZE SWR
                        WENT-AFTER WENT-BEFORE SUCCESSOR PREDECESSOR
                        RANGE BEARING COURSE SPEED COURSEFROM SPEEDFROM)
)

(PUTPROPS SAME-AS ORACLE T)

(PUTPROPS ROUGHLY-THE-SAME-SPEED-AS ORACLE T)

(PUTPROPS ROUGHLY-THE-SAME-COURSE-AS ORACLE T)

(PUTPROPS IN-LANE ORACLE T)

(PUTPROPS INSIDE ORACLE T)

(PUTPROPS GREATER-THAN ORACLE T)

(PUTPROPS LESS-THAN ORACLE T)

(PUTPROPS CROSSPATHS ORACLE T)

(PUTPROPS GRAZE ORACLE T)

(PUTPROPS SWR ORACLE T)
```

```
(PUTPROPS WENT-AFTER ORACLE T)

(PUTPROPS WENT-BEFORE ORACLE T)

(PUTPROPS SUCCESSOR ORACLE T)

(PUTPROPS PREDECESSOR ORACLE T)

(PUTPROPS RANGE ORACLE T)

(PUTPROPS BEARING ORACLE T)

(PUTPROPS COURSE ORACLE T)

(PUTPROPS SPEED ORACLE T)

(PUTPROPS SUCCESSOR ORTYPE LASTARG)

(PUTPROPS PREDECESSOR ORTYPE LASTARG)

(PUTPROPS RANGE ORTYPE LASTARG)

(PUTPROPS BEARING ORTYPE LASTARG)

(PUTPROPS COURSE ORTYPE LASTARG)

(PUTPROPS SPEED ORTYPE LASTARG)

(PUTPROPS COURSEFROM ORTYPE LASTARG)

(PUTPROPS SPEEDFROM ORTYPE LASTARG)

(RPAQQ ORACLEFNS (SAME-AS ROUGHLY-THE-SAME-SPEED-AS
                          ROUGHLY-THE-SAME-COURSE-AS IN-LANE INSIDE
                          GETATTB GREATER-THAN LESS-THAN BEARING SPEED
                          INTERIOR DISTANCE DISTOLINE INLANE LINPOLY
                          CROSSBOUNDARY SOMELINESEG TRACKINPOLY
                          CROSSLINES OPSIDES ROTSENSE SUBTEND LANERANGE
                          WITHINR CROSSPATHS LOCATION POSS-REPORT
                          DISSIMILPLAT WENT-BEFORE WENT-AFTER LOC-TIME
                          SWR SPEEDM GRAZE SUCCESSOR PREDECESSOR
                          DIRECTION RANGE COURSE SPEEDAUX COURSEFROM
                          SPEEDFROM))
(DEFINEQ
                                                                [173]

(SAME-AS
  [LAMBDA (W U)                                    (* edited:          |
                                                   "25-Jul-79 19:16")  |
    (EQ W U])
                                                                [174]

(ROUGHLY-THE-SAME-SPEED-AS
  [LAMBDA (Q1 Q2)                                  (* edited:          |
                                                   " 6-Aug-79 20:31")  |
```

```
        (* Speeds are considered to be roughly the same if
        they are within 5 per cent of each other.)


    (AND (GREATERP (PLUS Q2 (TIMES Q2 .05))
                   Q1)
         (GREATERP Q1 (DIFFERENCE Q2 (TIMES Q2 .05])
```

[175]

```
(ROUGHLY-THE-SAME-COURSE-AS
  [LAMBDA (Q1 Q2)                                    (* edited:
                                                     " 6-Aug-79 19:20")

        (* Two courses are considered to be roughly the same
        if they differ by at most 4.5 percent.)


    (AND (GREATERP (PLUS Q2 4.5)
                   Q1)
         (GREATERP Q1 (DIFFERENCE Q2 4.5])
```

[176]

```
(IN-LANE
  [LAMBDA (MLANE POS)                                (* edited:
                                                     " 6-Aug-79 19:24")

        (* If the centroid of the position is within 5
        nautical miles of the given lane, this function
        returns true.)


    (PROG ((Y (CENTROID POS))
           (X (LAST MLANE)))
          (RETURN (FGREATERP 5.0 (LANERANGE (CAAR MLANE)
                                            (CADAR MLANE)
                                            (CAAR X)
                                            (CADAR X)
                                            (CAR Y)
                                            (CADR Y])
```

[177]

```
(INSIDE
  [LAMBDA (POS STORM)                                (* edited:
                                                     " 6-Aug-79 19:28")

        (* This function returns true if the centroid of the
        position is interior to the polygon.)


    (APPLY (FUNCTION INTERIOR)
           (APPEND (CENTROID POS)
                   (CONS STORM])
```

[178]

```
(GETATTB
  [LAMBDA (REL NODE)                                    (* edited:
                                                        "26-Jul-79 18:22")

    (PROG [(SPEC (QUOTE (SIGHTING * SIGHTING3]
          (RPLACA SPEC REL)
          (RPLACA (CDR SPEC)
                  (QUOTE *))
          (RPLACA (CDDR SPEC)
                  NODE)
          (RETURN (CADR (GETUPLE (CAR (STRIPSTREAM (GETSH SPEC])
```

[179]

```
(GREATER-THAN
  [LAMBDA (Q1 Q2)                                       (* edited:
                                                        "25-Jul-79 13:55")

    (GREATERP Q1 Q2])
```

[180]

```
(LESS-THAN
  [LAMBDA (Q1 Q2)                                       (* edited:
                                                        "25-Jul-79 13:56")

    (GREATERP Q2 Q1])
```

[181]

```
(BEARING
  [LAMBDA (SITE)                                        (* edited:
                                                        " 6-Aug-79 20:13")

          (* Bearing accepts a sighting node and returns the
          bearing from the ownship to the sighted platform.)


    (PROG (POS1 POS2 TIME)
          (SETQ TIME (GETATT (QUOTE TOS)
                             SITE))
          (SETQ POS1 (OWNPOS TIME))
          (SETQ POS2 (CENTROID (GETATT (QUOTE POSITION)
                                       SITE)))
          (RETURN (DIRECTION (CAR POS1)
                             (CADR POS1)
                             (CAR POS2)
                             (CADR POS2])
```

[182]

```
(SPEED
  [LAMBDA (SITE)                                        (* edited:
                                                        " 7-Aug-79 12:49")

          (* Speed accepts a sighting node and computes an
          estimated speed using the closer of the predecessor
          or successor.)
```

```
    (PROG (PRED SUC TPRED TSUC PPRED PSUC POS TIME)
          (SETQ TIME (GETATT (QUOTE TOS)
                             SITE))
          (SETQ POS (CENTROID (GETATT (QUOTE POSITION)
                                      SITE)))
          (SETQ PRED (PREDECESSOR SITE))
          (SETQ SUC (SUCCESSOR SITE))
          [COND
            (SUC (SETQ TSUC (GETATT (QUOTE TOS)
                                    SUC))
                 (SETQ PSUC (CENTROID (GETATT (QUOTE POSITION)
                                              SUC]
          [COND
            (PRED (SETQ TPRED (GETATT (QUOTE TOS)
                                      PRED))
                  (SETQ PPRED (CENTROID (GETATT (QUOTE POSITION)
                                                PRED]
          (COND
            ((AND (NULL PRED)
                  (NULL SUC)
                  (RETURN)))
            [(NULL PRED)
              (RETURN (SPEEDM TIME TSUC (DISTANCE (CAR POS)
                                                  (CADR POS)
                                                  (CAR PSUC)
                                                  (CADR PSUC]
            [(NULL SUC)
              (RETURN (SPEEDM TPRED TIME (DISTANCE (CAR PPRED)
                                                   (CADR PPRED)
                                                   (CAR POS)
                                                   (CADR POS]
            [(LESSP (FDIFFERENCE TIME TPRED)
                    (FDIFFERENCE TSUC TIME))
              (RETURN (SPEEDM TPRED TIME (DISTANCE (CAR PPRED)
                                                   (CADR PPRED)
                                                   (CAR POS)
                                                   (CADR POS]
            (T (RETURN (SPEEDM TIME TSUC (DISTANCE (CAR POS)
                                                   (CADR POS)
                                                   (CAR PSUC)
                                                   (CADR PSUC])

                                                                [183]

(INTERIOR
  [LAMBDA (OLAT OLON POLYGON)                    (* edited:
                                                 "30-Jul-79 10:54")

          (* This function determines whether the point
          (OLAT OLON) is inside a polygon.
          The value of POLYGON must be a list of the vertices
          in either clockwise or counter-clockwise
          (starting anywhere) order. Each vertex is
          represented by a two element list containing the
          latitude and longitude.)
```

```
    (PROG ((SUM 0.0)
           (POS1 (POLYGON:-1)))
          (SETN SUM 0.0)                          (* Must reinitialize SUM
                                                  because of SETNs)
          (for POS in POLYGON
             do (PROG ((LAT (POS:1))
                       (LON (POS:2))
                       (LAT1 (POS1:1))
                       (LON1 (POS1:2))
                       (INC 0.0))
                      (SETN INC ((DIRECTION OLAT OLON LAT LON)
                                 -(DIRECTION OLAT OLON LAT1 LON1)))
                      (if INC LT -180
                          then (SETN INC (INC+360))
                        elseif INC GT 180
                          then (SETN INC (INC-360)))
                      (SETN SUM (SUM+INC))
                      (POS1_POS)))
          (RETURN ((ABS SUM)
                   GT 180])
```

[184]

```
(DISTANCE
  [LAMBDA (LAT1 LON1 LAT2 LON2)
    (FTIMES 60 (SUBTEND LAT1 LON1 LAT2 LON2])
```

[185]

```
(DISTOLINE
  [LAMBDA (X Y X1 Y1 X2 Y2)                     (* edited:
                                                "19-Jul-79 17:22")

          (* Computes the distance from a given point to a
          line segment between two given points)


    (PROG ((A 1.369063E34)
           (B 1.369063E34)
           (C 1.369063E34)
           (COS1 0.0)
           (COS2 0.0))
          (SETN A (DISTANCE X Y X1 Y1))
          (SETN B (DISTANCE X Y X2 Y2))
          (SETN C (DISTANCE X1 Y1 X2 Y2))
          (SETN COS1 (FDIFFERENCE (FPLUS (FTIMES A A)
                                         (FTIMES C C))
                                  (FTIMES B B))/(2*A*C))
          (SETN COS2 (FDIFFERENCE (FPLUS (FTIMES B B)
                                         (FTIMES C C))
                                  (FTIMES A A))/(2*B*C))
          (RETURN (COND
                    ((OR (MINUSP COS1)
                         (MINUSP COS2))
                      (MIN A B))
```

```
                    (T (FTIMES A (SIN (ARCCOS (MIN 1 COS1])
```

[186]

```
(INLANE
  [LAMBDA (X Y LANE)                                    (* NOBIND
                                                        "15-Dec-78 14:06")
    (PROG ((X1 68.39)
           (Y1 -16.57)
           (X2 68.39)
           (Y2 -16.57))
          (SETN X1 LANE:1:1)
          (SETN Y1 LANE:1:2)
          (if [SOME LANE::1
                    (FUNCTION (LAMBDA (LANEPOINT)
                        (SETN X2 LANEPOINT:1)
                        (SETN Y2 LANEPOINT:2)
                        (PROG1 (LESSP (DISTOLINE X Y X1 Y1 X2 Y2)
                                      MERCHANTLANEWIDTH)
                               (SETN X1 X2)
                               (SETN Y1 Y2]
              then (RETURN T])
```

[187]

```
(LINPOLY
  [LAMBDA (PT1 PT2 POLY)                                (* Checks if any part of
                                                        line segment is in
                                                        polygon)
    (OR (CROSSBOUNDARY PT1 PT2 POLY)
        (INTERIOR PT1:1 PT1:2 POLY])
```

[188]

```
(CROSSBOUNDARY
  [LAMBDA (PT1 PT2 POLY)                                (* Determines whether
                                                        line from PT1 to PT2
                                                        crosses the boundary of
                                                        POLY)
    (SOMELINESEG POLY (FUNCTION (LAMBDA (PT3 PT4)
                      (CROSSLINES PT1 PT2 PT3 PT4])
```

[189]

```
(SOMELINESEG
  [LAMBDA (SOMELINESEGX SOMELINESEGFN)

          (* This is an analogue of SOME that treats a list of
          points (coord pairs) as a list of line segments and
          returns T if SOMELINESEGFN is satisfied by one of
          the line segments. SOMELINESEGFN must be a function
          of two variables for the two points of the line
          segment)


    (PROG ((SOMELINESEGPT1 (SOMELINESEGX:1)))
          (if [SOME SOMELINESEGX::1 (FUNCTION (LAMBDA (SOMELINESEGPT2)
```

```
                    (PROG1 (APPLY* SOMELINESEGFN SOMELINESEGPT1
                                   SOMELINESEGPT2)
                           SOMELINESEGPT1_SOMELINESEGPT2]
          then (RETURN T])
```

[190]

```
(TRACKINPOLY
  [LAMBDA (TRACK POLY)                          (* Determines if a track
                                                intersects a polygon)
    (SOMELINESEG TRACK (FUNCTION (LAMBDA (TRACKPT1 TRACKPT2)
                  (LINPOLY TRACKPT1 TRACKPT2 POLY])
```

[191]

```
(CROSSLINES
  [LAMBDA (A B P Q)

          (* The lines AB and PQ cross iff A and B are on
          opposite sides of PQ and P and Q are on opposite
          sides of AB)


    (AND (OPSIDES A B P Q)
         (OPSIDES P Q A B])
```

[192]

```
(OPSIDES
  [LAMBDA (A B P Q)                             (* Tests if A and B are
                                                on opposite sides of PQ)
    (ROTSENSE A P Q)=(ROTSENSE Q P B])
```

[193]

```
(ROTSENSE
  [LAMBDA (A B C)                               (* edited:
                                                "30-Jul-79 10:54")
                                                (* Tests if the minimal
                                                rotation from BA to BC
                                                is clockwise)
    (PROG [(ANGLE ((DIRECTION B:1 B:2 C:1 C:2)                          |
                   -(DIRECTION B:1 B:2 A:1 A:2]                         |
          (RETURN (if ANGLE LT -180.0
                      then T
                    elseif ANGLE GT 180.0
                      then NIL
                    elseif (MINUSP ANGLE)
                      then NIL
                    else T])
```

[194]

```
(SUBTEND
  [LAMBDA (LAT1 LON1 LAT2 LON2)

          (* Gives the angle at the center of the earth
```

```
          subtended by the two points)


    (COND
      ((EQP LON1 LON2)
        (ABS (FDIFFERENCE LAT1 LAT2)))
      (T (PROG [(C1 (COS (FPLUS LAT1 LAT2)))
                (C2 (COS (FDIFFERENCE LAT1 LAT2)))
                (C3 (COS (FDIFFERENCE LON1 LON2]
               (RETURN (ARCCOS (FQUOTIENT (FPLUS (FTIMES (FPLUS C1 C2)
                                                         C3)
                                                 C2
                                                 (FMINUS C1))
                                          2.0])
```

[195]

```
(LANERANGE
  [LAMBDA (ALAT ALON BLAT BLON CLAT CLON)
    (PROG ((CAT (COS ALAT))
           (SAT (SIN ALAT))
           (CAN (COS ALON))
           (SAN (SIN ALON))
           (CBT (COS BLAT))
           (SBT (SIN BLAT))
           (CBN (COS BLON))
           (SBN (SIN BLON))
           (CCT (COS CLAT))
           (SCT (SIN CLAT))
           (CCN (COS CLON))
           (SCN (SIN CLON))
           (A1 0.0)
           (A2 0.0)
           (B1 0.0)
           (B2 0.0)
           (C1 2.535301E30)
           (C2 0.0)
           A3 B3 C3)
          (SETN A1 (FTIMES CAT CAN))
          (SETN B1 (FTIMES CBT CBN))
          (SETN C1 (FTIMES CCT CCN))
          (SETN A2 (FTIMES CAT SAN))
          (SETN B2 (FTIMES CBT SBN))
          (SETN C2 (FTIMES CCT SCN))
          (SETQ A3 SAT)
          (SETQ B3 SBT)
          (SETQ C3 SCT)
          (RETURN
            (FTIMES
              60.0
              (ABS
                (FDIFFERENCE
                  90.0
                  (ARCCOS
                    (FQUOTIENT
                      [FPLUS [FDIFFERENCE (FTIMES A1
                                                  (FDIFFERENCE
```

```
                                                    (FTIMES B2 C3)
                                                    (FTIMES B3 C2)))
                                          (FTIMES A2
                                                  (FDIFFERENCE
                                                    (FTIMES B1 C3)
                                                    (FTIMES B3 C1]
                                  (FTIMES A3 (FDIFFERENCE (FTIMES B1 C2)
                                                    (FTIMES B2 C1]
                        (SIN (SUBTEND ALAT ALON BLAT BLON])
```

[196]

```
(WITHINR
  [NLAMBDA L                                        (* NOBIND
                                                    "14-Nov-78 19:25")
    (NCONC WITHINRFNS L)
    (MAKEFILE (QUOTE WITHINR.LSP])
```

[197]

```
(CROSSPATHS
  [LAMBDA (S1 S2 T1 T2)                             (* edited:
                                                    "26-Jul-79 12:11")

          (* Tests if path from sightings S1 to S2 crosses
          that from T1 to T2)


    (PROG ((P1 (CENTROID S1))
           (P2 (CENTROID S2))
           (Q1 (CENTROID T1))
           (Q2 (CENTROID T2)))
          (RETURN (CROSSLINES P1 P2 Q1 Q2])
```

[198]

```
(LOCATION
  [LAMBDA (S)                                       (* edited:
                                                    "24-Jul-79 17:17")
    (CENTROID (GETATT (QUOTE POSITION)
                      S])
```

[199]

```
(POSS-REPORT
  [LAMBDA (S1 S2 PATROL)                            (* edited:
                                                    "24-Jul-79 12:08")
    (PROG (SUCCESSFLG PLAT1)
          (SETQ PLAT1 (GETATTB (QUOTE SIGHTING)
                               S1))
          [MAPC (GETATTB (QUOTE SOURCE)
                         PATROL)
                (FUNCTION (LAMBDA (SNG)
                    (PROG NIL
                          (PROG ((PLAT2 (GETATTB (QUOTE SIGHTING)
                                                 SNG)))
                                (COND
```

```
                                    ((NOT (DISSIMILPLAT PLAT1 PLAT2))
                                      (SETQ SUCCESSFLG T]
          (RETURN SUCCESSFLG])

                                                                    [200]

(DISSIMILPLAT
  [LAMBDA (PLAT1 PLAT2)                          (* edited:
                                                 "19-Jul-79 17:28")
    (PROG (SUCCESSFLG VAL1 VAL2)
          [MAPC SHIPCHARS (FUNCTION (LAMBDA (CHAR)
                    (SETQ VAL1 (GETATT CHAR PLAT1))
                    (SETQ VAL2 (GETATT CHAR PLAT2))
                    (AND VAL1 VAL2 (NOT (EQUAL VAL1 VAL2))
                         (SETQ SUCCESSFLG T]
          (RETURN SUCCESSFLG])

                                                                    [201]

(WENT-BEFORE
  [LAMBDA (S1 T1 S2 T2 S3 T3 S4 T4)              (* edited:
                                                 "30-Jul-79 10:56")
                                                 (* Tests if could have
                                                 gotten from S1 to S2
                                                 before patrol
                                                 overflight)
    (PROG ((L1 (CENTROID S1))
           (L2 (CENTROID S2))
           (L3 (CENTROID S3))
           (L4 (CENTROID S4))
           THETA PHI VM1 VM2 VP1 VP2 PSI INITDIST FINDIST MINDIST
           MINTIME P0 P4)
          (if T2 lt T3
              then                               (* Got to M2 before
                                                 patrol arrived at P1)
                   (RETURN T))
          (PHI_(DIRECTION L1:1 L1:2 L2:1 L2:2))
          (VM1_MAXSHIPSPEED*(COS PHI)/60)
          (VM2_MAXSHIPSPEED*(SIN PHI)/60)
          (VP1_(L3:1-L4:1)/(T3-T4))
          (VP2_(L3:2-L4:2)/(T3-T4))
          (P0_ <L3:1+(T1-T3)*VP1 L3:2+(T1-T3)*VP2>)
          (P4_ <L3:1+(T2-T3)*VP1 L3:2+(T2-T3)*VP2>)
                                                 (* Projected positions
                                                 of patrol)
          (PSI_(ARCTAN (VM2-VP2)/(VM1-VP1)))
          (THETA_(ABS PSI-(DIRECTION L1:1 L1:2 P0:1 P0:2)))
          (if THETA gt 180
              then THETA_(360-THETA))
          (INITDIST_(DISTANCE L1:1 L1:2 P0:1 P0:2))
          (FINDIST_(DISTANCE L2:1 L2:2 P4:1 P4:2))
          (if THETA gt 90 and INITDIST gt PATROLRANGE
              then (RETURN T))
          (MINDIST_INITDIST*(SIN THETA))
          (MINTIME_(60*INITDIST*(COS THETA))/MAXSHIPSPEED+T1)
          (if MINDIST gt PATROLRANGE
              then (RETURN T)
```

```
            elseif MINTIME gt T2 and FINDIST gt PATROLRANGE
              then (RETURN T])
```

[202]

```
(WENT-AFTER
  [LAMBDA (S1 T1 S2 T2 S3 T3 S4 T4)                    (* edited:
                                                       "30-Jul-79 10:55")
                                                       (* Tests if could have
                                                       gotten from S1 to S2
                                                       after patrol overflight)
    (PROG ((L1 (CENTROID S1))
           (L2 (CENTROID S2))
           (L3 (CENTROID S3))
           (L4 (CENTROID S4))
           THETA PHI VM1 VM2 VP1 VP2 PSI INITDIST ENDDIST MINDIST
           MINTIME P0 P4)
          (if T1 gt T4
              then                                     (* Got to M1 after
                                                       patrol arrived at P2)
                   (RETURN T))
          (PHI_(DIRECTION L1:1 L1:2 L2:1 L2:2))
          (VM1_MAXSHIPSPEED*(COS PHI)/60)
          (VM2_MAXSHIPSPEED*(SIN PHI)/60)
          (VP1_(L3:1-L4:1)/(T3-T4))
          (VP2_(L3:2-L4:2)/(T3-T4))
          (P0_ <L3:1+(T1-T3)*VP1 L3:2+(T1-T3)*VP2>)
          (P4_ <L3:1+(T2-T3)*VP1 L3:2+(T2-T3)*VP2>)
                                                       (* Projected positions
                                                       of patrol)
          (PSI_(ARCTAN (VM2-VP2)/(VM1-VP1)))
          (THETA_(ABS PSI-(DIRECTION P4:1 P4:2 L2:1 L2:2)))
          (if THETA gt 180
              then THETA_(360-THETA))
          (INITDIST_(DISTANCE L1:1 L1:2 P0:1 P0:2))
          (ENDDIST_(DISTANCE L2:1 L2:2 P4:1 P4:2))
          (if THETA gt 90 and ENDDIST gt PATROLRANGE
              then (RETURN T))
          (MINDIST_ENDDIST*(SIN THETA))
          (MINTIME_(-60*ENDDIST*(COS THETA))/MAXSHIPSPEED+T2)
          (if MINDIST gt PATROLRANGE
              then (RETURN T)
            elseif MINTIME lt T1 and INITDIST gt PATROLRANGE
              then (RETURN T])
```

[203]

```
(LOC-TIME
  [LAMBDA (S)                                          (* edited:
                                                       "24-Jul-79 17:51")
    (NCONC1 (CENTROID (GETATT (QUOTE POSITION)
                              S))
            (GETATT (QUOTE TOS)
                    S])
```

[204]

```
(SWR
  [LAMBDA (LT1 T1 LT2 T2)                          (* edited:
                                                   "26-Jul-79 12:25")

          (* Tests if sighting S1 is simply-within-reach of
          S2, ie. by travelling straight ahead with max ship
          speed)


    (PROG ((L1 (CENTROID LT1))
           (L2 (CENTROID LT2)))
          (RETURN (LESSP (SPEEDM T1 T2 (DISTANCE (CAR L1)
                                                 (CADR L1)
                                                 (CAR L2)
                                                 (CADR L2)))
                         MAXSHIPSPEED])
```

[205]

```
(SPEEDM
  [LAMBDA (T1 T2 DIST)                             (* edited:
                                                   " 8-Aug-79 09:09")
    (ABS (SPEEDAUX (FQUOTIENT T1 60)
                   (FQUOTIENT T2 60)
                   DIST])
```

[206]

```
(GRAZE
  [LAMBDA (S1 S2 T1 T2)                            (* edited:
                                                   " 6-Aug-79 20:03")

          (* Given two sightings of each of two platforms,
          graze returns true if the paths of the platforms are
          within the patrolrange. Time is not considered.)


    (PROG ((POS1 (CENTROID S1))
           (POS2 (CENTROID S2))
           (POS3 (CENTROID T1))
           (POS4 (CENTROID T2)))
          (RETURN (OR (LESSP (DISTOLINE (CAR POS1)
                                        (CADR POS1)
                                        (CAR POS3)
                                        (CADR POS3)
                                        (CAR POS4)
                                        (CADR POS4))
                             PATROLRANGE)
                      (LESSP (DISTOLINE (CAR POS2)
                                        (CADR POS2)
                                        (CAR POS3)
                                        (CADR POS3)
                                        (CAR POS4)
                                        (CADR POS4))
                             PATROLRANGE])
```

[207]

```
(SUCCESSOR
  [LAMBDA (SITE)                                        (* edited:
                                                        " 6-Aug-79 20:07")

          (* Given a sighting node this function returns the
          next sighting in time or nil if there is no
          successor)


    (PROG (SUCC TOSX TOSSUC TOSSITE PLAT)
          (SETQ PLAT (GETATTB (QUOTE SIGHTING)
                              SITE))
          (SETQ TOSSITE (GETATT (QUOTE TOS)
                                SITE))
          [for X in (RETRIEVES (QUOTE SIGHTING)
                               PLAT
                               (QUOTE *)
                               3)
             do (PROG NIL
                      (SETQ TOSX (GETATT (QUOTE TOS)
                                         X))
                      (COND
                        ((LESSP TOSSITE TOSX)
                          (COND
                            ((OR (NULL SUCC)
                                 (LESSP TOSX TOSSUC))
                              (SETQ SUCC X)
                              (SETQ TOSSUC TOSX]
          (RETURN SUCC])
```

[208]

```
(PREDECESSOR
  [LAMBDA (SITE)                                        (* edited:
                                                        " 6-Aug-79 20:09")

          (* Given a sighting node this function returns the
          previous sighting in time, or nil if there was no
          previous sighting.)


    (PROG (PRED TOSX TOSPRED TOSSITE PLAT)
          (SETQ PLAT (GETATTB (QUOTE SIGHTING)
                              SITE))
          (SETQ TOSSITE (GETATT (QUOTE TOS)
                                SITE))
          [for X in (RETRIEVES (QUOTE SIGHTING)
                               PLAT
                               (QUOTE *)
                               3)
             do (PROG NIL
                      (SETQ TOSX (GETATT (QUOTE TOS)
                                         X))
                      (COND
```

```
                        ((LESSP TOSX TOSSITE)
                         (COND
                           ((OR (NULL PRED)
                                (LESSP TOSPRED TOSX))
                            (SETQ PRED X)
                            (SETQ TOSPRED TOSX]
          (RETURN PRED])
```

[209]

```
(DIRECTION
  [LAMBDA (LAT1 LON1 LAT2 LON2)                    (* edited:
                                                   " 7-Aug-79 17:40")
    (PROG ((PSI 0.0)
           (LONDIF 0.0)
           (BEARSIN 0.0)
           (BEARANGLE 0.0))
          (SETN PSI (SUBTEND LAT1 LON1 LAT2 LON2))
          (SETN LONDIF (FDIFFERENCE LON2 LON1))
          (COND
            ((EQP LAT1 90.0)
              (RETURN 180.0))
            ((EQP LAT1 -90.0)
              (RETURN 0.0)))
          (SETN BEARSIN (FQUOTIENT (FTIMES (COS LAT2)
                                           (SIN LONDIF))
                                   (SIN PSI)))
          (COND
            ((FGTP BEARSIN 1.0)
              (SETN BEARSIN 1.0)))
          (COND
            ((LESSP BEARSIN -1.0)
              (SETN BEARSIN -1.0)))
          (SETN BEARANGLE (ARCSIN BEARSIN))
          [COND
            ((LESSP LAT2 LAT1)
              (SETN BEARANGLE (FDIFFERENCE 180.0 BEARANGLE]
          [COND
            ((MINUSP BEARANGLE)
              (SETN BEARANGLE (FPLUS 360.0 BEARANGLE]
          (RETURN BEARANGLE])
```

[210]

```
(RANGE
  [LAMBDA (SITE)                                   (* edited:
                                                   " 6-Aug-79 20:15")

          (* Range accepts a sighting node and computes the
          distance from the ownship to the platform sighted.)


    (PROG (POS1 POS2 TIME)
          (SETQ TIME (GETATT (QUOTE TOS)
                             SITE))
          (SETQ POS1 (OWNPOS TIME))
          (SETQ POS2 (CENTROID (GETATT (QUOTE POSITION)
```

```
                                        SITE)))
          (RETURN (DISTANCE (CAR POS1)
                            (CADR POS1)
                            (CAR POS2)
                            (CADR POS2])
```

[211]

```
(COURSE
  [LAMBDA (SITE)                                    (* edited:
                                                    " 7-Aug-79 10:53")

          (* Course accepts a sighting node and computes an
          estimated course. To do this the closer
          (in time) of the predecessor or successor is used.)


    (PROG (PRED SUC TPRED TSUC PPRED PSUC POS TIME)
          (SETQ TIME (GETATT (QUOTE TOS)
                             SITE))
          (SETQ POS (CENTROID (GETATT (QUOTE POSITION)
                                      SITE)))
          (SETQ PRED (PREDECESSOR SITE))
          (SETQ SUC (SUCCESSOR SITE))
          [COND
            (SUC (SETQ TSUC (GETATT (QUOTE TOS)
                                    SUC))
                 (SETQ PSUC (CENTROID (GETATT (QUOTE POSITION)
                                              SUC]
          [COND
            (PRED (SETQ TPRED (GETATT (QUOTE TOS)
                                      PRED))
                  (SETQ PPRED (CENTROID (GETATT (QUOTE POSITION)
                                                PRED]
          (COND
            ((AND (NULL PRED)
                  (NULL SUC)
                  (RETURN)))
            [(NULL PRED)
              (RETURN (DIRECTION (CAR POS)
                                 (CADR POS)
                                 (CAR PSUC)
                                 (CADR PSUC]
            [(NULL SUC)
              (RETURN (DIRECTION (CAR PPRED)
                                 (CADR PPRED)
                                 (CAR POS)
                                 (CADR POS]
            [(LESSP (FDIFFERENCE TIME TPRED)
                    (FDIFFERENCE TSUC TIME))
              (RETURN (DIRECTION (CAR PPRED)
                                 (CADR PPRED)
                                 (CAR POS)
                                 (CADR POS]
            (T (RETURN (DIRECTION (CAR POS)
                                  (CADR POS)
                                  (CAR PSUC)
```

```
                                    (CADR PSUC])

                                                                    [212]

(SPEEDAUX
  [LAMBDA (T1 T2 DIST)                                  (* edited:
                                                        "30-Jul-79 18:59")
    (FQUOTIENT DIST (FDIFFERENCE T2 T1])

                                                                    [213]

(COURSEFROM
  [LAMBDA (POS1 POS2)                                   (* edited:
                                                        " 7-Aug-79 17:36")
    (SETQ POS1 (CENTROID POS1))
    (SETQ POS2 (CENTROID POS2))
    (DIRECTION (CAR POS1)
               (CADR POS1)
               (CAR POS2)
               (CADR POS2])

                                                                    [214]

(SPEEDFROM
  [LAMBDA (POS1 T1 POS2 T2)                             (* edited:
                                                        " 7-Aug-79 17:54")
    (SETQ POS1 (CENTROID POS1))
    (SETQ POS2 (CENTROID POS2))
    (SPEEDM T1 T2 (DISTANCE (CAR POS1)
                            (CADR POS1)
                            (CAR POS2)
                            (CADR POS2])
)
(DECLARE: DONTEVAL@LOAD DOEVAL@COMPILE DONTCOPY COMPILERVARS

(ADDTOVAR NLAMA WITHINR)

(ADDTOVAR NLAML )

(ADDTOVAR LAMA )
)
(DECLARE: DONTCOPY
  (FILEMAP (NIL (2459 25278 (SAME-AS 2471 . 2596) (
ROUGHLY-THE-SAME-SPEED-AS 2600 . 3038) (ROUGHLY-THE-SAME-COURSE-AS 3042
. 3424) (IN-LANE 3428 . 3958) (INSIDE 3962 . 4322) (GETATTB 4326 . 4652)
 (GREATER-THAN 4656 . 4794) (LESS-THAN 4798 . 4933) (BEARING 4937 . 5532
) (SPEED 5536 . 7000) (INTERIOR 7004 . 8061) (DISTANCE 8065 . 8154) (
DISTOLINE 8158 . 8943) (INLANE 8947 . 9441) (LINPOLY 9445 . 9639) (
CROSSBOUNDARY 9643 . 9892) (SOMELINESEG 9896 . 10516) (TRACKINPOLY 10520
 . 10739) (CROSSLINES 10743 . 10962) (OPSIDES 10966 . 11120) (ROTSENSE
11124 . 11616) (SUBTEND 11620 . 12070) (LANERANGE 12074 . 13253) (
WITHINR 13257 . 13413) (CROSSPATHS 13417 . 13807) (LOCATION 13811 .
13972) (POSS-REPORT 13976 . 14572) (DISSIMILPLAT 14576 . 14972) (
WENT-BEFORE 14976 . 16560) (WENT-AFTER 16564 . 18136) (LOC-TIME 18140 .
18348) (SWR 18352 . 18841) (SPEEDM 18845 . 19038) (GRAZE 19042 . 19818)
(SUCCESSOR 19822 . 20659) (PREDECESSOR 20663 . 21518) (DIRECTION 21522 .
 22474) (RANGE 22478 . 23172) (COURSE 23176 . 24559) (SPEEDAUX 24563 .
```

```
24701) (COURSEFROM 24705 . 24972) (SPEEDFROM 24976 . 25275)))))
STOP
```

```
(FILECREATED " 6-Aug-79 11:01:50" <DKIBLER>PLAT.LSP.48 10184


     changes to:  PLATFNS GETATT ESTIMATE NEAREST ONEPOINT CENTROID
GETPOINT FIXLONG

     previous date: "24-Jul-79 18:00:26" <DKIBLER>PLAT.LSP.47)


(PRETTYCOMPRINT PLATCOMS)

(RPAQQ PLATCOMS ((FNS * PLATFNS)))

(RPAQQ PLATFNS (GETATT ESTIMATE NEAREST ONEPOINT PLATPOS PREDICTPOS
                       SPAN AUXINTERPOL CENTROID GETPOINT FIXLONG))
(DEFINEQ

                                                                  [215]

(GETATT
  [LAMBDA (REL NAME)                                  (* edited:
                                                      " 6-Aug-79 10:24")

          (* This function accepts a two-argument relation
          name together with its first argument and returns
          the first instance of the second argument which
          satisfies the relation. It is useful when the
          relation is infact a function.)


    (PROG [(SPEC (QUOTE (NIL NIL *]
          (RPLACA SPEC REL)
          (RPLACA (CDR SPEC)
                  NAME)
          (RETURN (CADDR (GETUPLE (CAR (STRIPSTREAM (GETSH SPEC])

                                                                  [216]

(ESTIMATE
  [LAMBDA (SITE1 SITE2 GAP)                           (* edited:
                                                      " 6-Aug-79 10:33")

          (* This function accepts two sightings and a
          normalized time factor and returns an estimated
          position. The estimated position may be in the
          future or past, and will be a polygon if either
          position of a sighting is a polygon.
          The normalize time factor is the desired time minus
          the time of sightingl divided by the difference in
          the time of the sightings.)


    (PROG1 [MAPCAR (SPAN (GETATT (QUOTE POSITION)
                                 SITE1)
                         (GETATT (QUOTE POSITION)
                                 SITE2))
                   (FUNCTION (LAMBDA (X)
```

```
                    (AUXINTERPOL (CAR X)
                                 (CADR X)
                                 GAP]
          (AND EXPLAINFLAG (PRIN1 "Estimated from the sightings ")
               (PRIN1 SITE1)
               (PRIN1 " and ")
               (PRIN1 SITE2)
               (TERPRI])
```

[217]

```
(NEAREST
  [LAMBDA (PT LST)                                    (* edited:
                                                      " 6-Aug-79 10:40")

          (* Given a point P and a list of points L, this
          function returns the point of L nearest to P.
          Each point is a latitude-longitude pair.)


    (PROG ((ANS (CAR LST))
           Y TEMP)
          (SETQ TEMP (DISTANCE (CAR PT)
                               (CADR PT)
                               (CAR ANS)
                               (CADR ANS)))
          [for X in (CDR LST) do (COND
                                   ((FLESSP (SETQ Y
                                                  (DISTANCE (CAR PT)
                                                            (CADR PT)
                                                            (CAR X)
                                                            (CADR X)))
                                            TEMP)
                                    (SETQ ANS X)
                                    (SETQ TEMP Y]
          (RETURN ANS])
```

[218]

```
(ONEPOINT
  [LAMBDA (NODE GAP)                                  (* edited:
                                                      " 6-Aug-79 10:44")

          (* Given a single sighting and a time relative to
          that sighting, this function generates an estimated
          position which will be a polygon.)


    (PROG ((X (FTIMES .5 GAP))
           (POS (GETATT (QUOTE POSITION)
                        NODE))
           LAT LONG)
          (AND EXPLAINFLAG (PRIN1 "The only sighting node is ")
               (PRIN1 NODE)
               (PRIN1
                " and no course was known. Hence the polygon is large.")
               (TERPRI))
```

```
        (COND
          [(NULL (CDR POS))
            (SETQ LAT (CAAR POS))
            (SETQ LONG (CADAR POS))
            (SETQ X (FTIMES .5 GAP))


        (* .5 is the approximate speed in degrees of a
        vessel. (60 knots=1 degree per hour))


            (RETURN (LIST (LIST (FDIFFERENCE LAT X)
                                (FDIFFERENCE LONG X))
                          (LIST (FPLUS LAT X)
                                (FDIFFERENCE LONG X))
                          (LIST (FPLUS LAT X)
                                (FPLUS LONG X))
                          (LIST (FDIFFERENCE LAT X)
                                (FPLUS LONG X]
          (T (RETURN (MAPCAR (SPAN (LIST (CENTROID POS))
                                   POS)
                             (FUNCTION (LAMBDA (Y)
                                 (AUXINTERPOL (CAR Y)
                                              (CADR Y)
                                              X])
```

[219]

```
(PLATPOS
  [LAMBDA (PLAT TIME)                                   (* edited:
                                                        "11-Jul-79 13:10")

        (* Given a platform and a time this function returns
        the latitude and longitude if an appropriate
        sighting has been made. If there are bounding
        sightings, a position is estimated by interpolation.
        If there are no bounding sightings, a polygon is
        computed by extrapolation and returned.)


    (PROG (X Y)
        (SETQ X (MAPCAR (RETRIEVER (LIST (QUOTE SIGHTING)
                                         PLAT
                                         (QUOTE *)))
                        (FUNCTION CDADR)))
        (COND
          [[SETQ Y (SUBSET X (FUNCTION (LAMBDA (Z)
                                 (EQUAL (GETATT (QUOTE TOS)
                                                Z)
                                        TIME]
            (AND EXPLAINFLAG (PRIN1
                               "We have a sighting of the platform.")
                 (TERPRI))
            (RETURN (GETATT (QUOTE POSITION)
                            (CAR Y]
          (X (RETURN (PREDICTPOS X TIME)))
          (EXPLAINFLAG (PRIN1 "No sighting of platform exists.")
```

```
                        (TERPRI])

                                                                [220]

(PREDICTPOS
  [LAMBDA (NODELIST TIME)                          (* edited:
                                                   "11-Jul-79 17:54")

        (* This function distributes the task of computing
        an approximate position depending on the number and
        type of sightings.)


    (PROG (LB UB LBT UBT LB2 UB2 LBT2 UB2)
          [MAPC NODELIST (FUNCTION (LAMBDA (X)
                    (PROG (XT)
                          (SETQ XT (GETATT (QUOTE TOS)
                                           X))
                          (COND
                            [(FLESSP XT TIME)
                              (COND
                                ((OR (NULL LB)
                                     (FLESSP LBT XT))
                                  (SETQ LB2 LB)
                                  (SETQ LBT2 LBT)
                                  (SETQ LB X)
                                  (SETQ LBT XT))
                                ((OR (NULL LBT2)
                                     (FLESSP LBT2 XT))
                                  (SETQ LBT2 XT)
                                  (SETQ LB2 X]
                            ((COND
                                ((OR (NULL UB)
                                     (FLESSP XT UBT))
                                  (SETQ UB2 UB)
                                  (SETQ UBT2 UBT)
                                  (SETQ UB X)
                                  (SETQ UBT XT))
                                ((OR (NULL UBT2)
                                     (FLESSP XT UBT2))
                                  (SETQ UBT2 XT)
                                  (SETQ UB2 X)))
                              (SETQ UB X)
                              (SETQ UBT XT]
          (RETURN (COND
                    [(AND UB LB)
                      (ESTIMATE LB UB (FQUOTIENT (FDIFFERENCE TIME LBT)
                                                 (FDIFFERENCE UBT LBT]
                    [UB2 (ESTIMATE UB UB2 (FQUOTIENT (FDIFFERENCE
                                                       TIME UBT)
                                                     (FDIFFERENCE
                                                       UBT2 UBT]
                    [LB2 (ESTIMATE LB LB2 (FQUOTIENT (FDIFFERENCE
                                                       TIME LBT)
                                                     (FDIFFERENCE
                                                       LBT LBT2]
                    (UB (ONEPOINT UB (FDIFFERENCE UBT TIME)))
```

```
                    (LB (ONEPOINT LB (FDIFFERENCE TIME LBT])

                                                                    [221]

(SPAN
  [LAMBDA (L1 L2)                                    (* edited:
                                                     "11-Jul-79 16:31")

          (* This function takes two polygons
          (possibly degenerate) and generates an approximation
          to the span of this polygons.)


    (COND
      [(IGREATERP (LENGTH L1)
                  (LENGTH L2))
        (MAPCAR L1 (FUNCTION (LAMBDA (X)
                     (LIST X (NEAREST X L2]
      (T (MAPCAR L2 (FUNCTION (LAMBDA (X)
                      (LIST (NEAREST X L1)
                            X])

                                                                    [222]

(AUXINTERPOL
  [LAMBDA (PT1 PT2 DELTA)                            (* edited:
                                                     "16-Jul-79 18:33")
    (LIST [FPLUS (CAR PT1)
                 (FTIMES DELTA (FDIFFERENCE (CAR PT2)
                                            (CAR PT1]
          (FIXLONG (FPLUS (CADR PT1)
                          (FTIMES DELTA (FIXLONG (FDIFFERENCE
                                                   (CADR PT2)
                                                   (CADR PT1])

                                                                    [223]

(CENTROID
  [LAMBDA (VERTEXLIST)                               (* edited:
                                                     " 6-Aug-79 10:46")

          (* Given a list of points, which are
          latitude-longitude pairs, this function returns the
          centroid of those points.)


    (PROG ((C1 (CAAR VERTEXLIST))
           (C2 (CADAR VERTEXLIST))
           (I 1))
          [COND
            ((NULL (CDR VERTEXLIST))
              (RETURN (CAR VERTEXLIST]
      LOOP(COND
            [(NULL (CDR VERTEXLIST))
              (RETURN (LIST (FQUOTIENT C1 I)
                            (FQUOTIENT C2 I]
            (T (SETQ I (ADD1 I))
```

```
            (SETQ VERTEXLIST (CDR VERTEXLIST))
            (SETQ C1 (FPLUS C1 (CAAR VERTEXLIST)))
            (SETQ C2 (FPLUS C2 (CADAR VERTEXLIST)))
            (GO LOOP])
```

[224]

```
(GETPOINT
  [LAMBDA (POS BEAR RANGE)
    (CLISP: FLOATING)                                    (* edited:
                                                         " 6-Aug-79 10:58")

          (* This function returns the new position reached by
          traveling from the given position
          (a latitude-longitude pair) at the given bearing for
          the given range.)


    (PROG ((LAT (POS:1))
           (LONG (POS:2))
           (PSI (RANGE/60))
           NEWLAT NEWLONG TMP TMP2 SINLAT COSPSI COSLAT SINPSI COSBEAR
           COSNEWLAT)
          (SINLAT_(SIN LAT))
          (COSPSI_(COS PSI))
          (COSLAT_(COS LAT))
          (SINPSI_(SIN PSI))
          (COSBEAR_(COS BEAR))
          (NEWLAT_(ARCSIN SINLAT*COSPSI+COSLAT*SINPSI*COSBEAR))
          (if (EQUAL 90 (ABS NEWLAT))
              then (RETURN <NEWLAT 0>))
          (COSNEWLAT_(COS NEWLAT))
          (TMP_SINPSI*(SIN BEAR)/COSNEWLAT)
          [TMP2_(ARCCOS (MAX -1 (MIN 1 (
                                 COSLAT*COSPSI-COSBEAR*SINLAT*SINPSI)
                                      /COSNEWLAT]
          (NEWLONG_LONG+(if TMP gt 0
                            then TMP2
                          else (-TMP2)))
          (NEWLONG_(FIXLONG NEWLONG))
          (RETURN <NEWLAT NEWLONG>])
```

[225]

```
(FIXLONG
  [LAMBDA (X)                                            (* edited:
                                                         " 6-Aug-79 11:01")

          (* Given a longitude whose absolute value is less
          than 360, this function will return a longitude in
          the proper range.)


    (COND
      ((FLESSP 180 X)
        (FDIFFERENCE X 360))
      ((FLESSP X -180)
```

```
        (FPLUS X 360))
      (T X])
)
(DECLARE: DONTCOPY
  (FILEMAP (NIL (422 10160 (GETATT 434 . 1065) (ESTIMATE 1069 . 2031) (
NEAREST 2035 . 2810) (ONEPOINT 2814 . 4086) (PLATPOS 4090 . 5041) (
PREDICTPOS 5045 . 6582) (SPAN 6586 . 7128) (AUXINTERPOL 7132 . 7466) (
CENTROID 7470 . 8252) (GETPOINT 8256 . 9714) (FIXLONG 9718 . 10157)))))
STOP
```

```
(FILECREATED "21-Aug-79 12:09:01" <PMORRIS>QH.LSP.72 8186

     changes to:  QHASK

     previous date: " 1-Aug-79 20:28:51" <PMORRIS>QH.LSP.71)


(PRETTYCOMPRINT QHCOMS)

(RPAQQ QHCOMS [(MACROS QHGET QHPUT)
               (FNS * QHFNS)
               (DECLARE: DONTEVAL@LOAD DOEVAL@COMPILE DONTCOPY
                         COMPILERVARS (ADDVARS (NLAMA QHTAKE PQ)
                                               (NLAML)
                                               (LAMA])
(DECLARE: EVAL@COMPILE

(PUTPROPS QHGET MACRO [(LOC OFF)
                       (GETHASH (VAG (IPLUS (ITIMES LOC 132)
                                            OFF 3])

(PUTPROPS QHPUT MACRO ((LOC OFF VAL)
                       (PUTHASH (VAG (IPLUS (ITIMES LOC 132)
                                            OFF 3))
                                VAL)))
)

(RPAQQ QHFNS (PQ QHCLEAR QHMAKE QHLIST QHASK BEEP QHTAKE QHFOLLOW
                 QHPREP QHSHOW))
(DEFINEQ

                                                                    [226]

(PQ
  [NLAMBDA L                                          (* edited:          |
                                                      " 1-Aug-79 13:26")  |
    (PROG ((SYSPRETTYFLG T))                                              |
          (SHOWPRINT (GETPROP (CAR L)                                     |
                              (QUOTE QHPRODS])

                                                                    [227]

(QHCLEAR
  [LAMBDA NIL                                         (* edited:
                                                      "15-Jun-79 18:44")
    (SETQ QUERYHASHPTR 0)                                                 |
    (CLRHASH])

                                                                    [228]

(QHMAKE
  [LAMBDA (QHMAKEX QHMAKEY SHOWFLG)                   (* edited:
                                                      "27-Jul-79 18:33")
    (PROG ((PTR 0)
           NEWPTR CHARCODE)
          (COND
            ((LISTP QHMAKEX)
```

```
            [MAPC QHMAKEX (FUNCTION (LAMBDA (X)
                        (QHMAKE X QHMAKEY SHOWFLG]
            (RETURN))
          ((EQ (NTHCHAR QHMAKEX 1)
               (QUOTE !))
            (COND
              (SHOWFLG (PRIN1 (COND                                    |
                                ((MEMB (NTHCHAR QHMAKEX 2)             |
                                       (QUOTE (A E I O U)))            |
                                  "an ")                               |
                                (T "a ")))                             |
                       (PRIN1 (SUBSTRING QHMAKEX 2))
                       (TERPRI))
              (T (QHMAKE (EVAL (MKATOM (SUBSTRING QHMAKEX 2)))
                         QHMAKEY)))
            (RETURN)))
        (COND
          (SHOWFLG (PRINT QHMAKEX)
                   (RETURN)))
        [RPTQ (NCHARS QHMAKEX)
              (PROGN [SETQ CHARCODE (CHCON1 (NTHCHAR QHMAKEX
                                                     (IMINUS RPTN]
                     (SETQ NEWPTR (QHGET PTR CHARCODE))
                     (COND
                       (NEWPTR (SETQ PTR NEWPTR))
                       (T (QHPUT PTR CHARCODE (SETQ QUERYHASHPTR
                                  (ADD1 QUERYHASHPTR)))
                          (QHPUT PTR 0 (COND
                                         ((QHGET PTR 0)
                                           T)
                                         (T CHARCODE)))
                          (SETQ PTR QUERYHASHPTR]
        (QHPUT PTR -1 QHMAKEX)
        (QHPUT PTR -2 QHMAKEY])
```

[229]

```
(QHLIST
  [LAMBDA (PTR)                                    (* edited:
                                                   "20-Jun-79 15:32")
    (PROG (ITEM)
          (COND
            (PTR (SETQ ITEM (QHGET PTR -1))
                 [COND
                   (ITEM (COND                                         |
                           ((EQ (NTHCHAR ITEM -1)                      |
                                (QUOTE $))                             |
                                                 (* Escape)            |
                            (PRIN1 (SUBSTRING ITEM 1 -2))              |
                            (PRIN1 "<anything>")                       |
                            (TERPRI))                                  |
                           (T (PRINT ITEM]                             |
                 (COND
                   ((QHGET PTR 0)
                     (RPTQ 129 (QHLIST (QHGET PTR (IDIFFERENCE 130 RPTN]
)
```

```
(QHASK
  [LAMBDA (INBUF)                                    (* edited:
                                                     "21-Aug-79 12:08")
    (RESETLST
      (RESETSAVE (CONTROL T))
      (RESETSAVE (ECHOMODE))
      (RESETSAVE (RAISE T))
      (RESETSAVE ([LAMBDA (X)                                          |
                    (ECHOCONTROL 8 X]                                  |
                  (QUOTE REAL)))                                       |
      (PROG (PTR BUFPTR NEWPTR CHAR ITEM CODE)
            (COND
              ((EQ (QHGET 0 0)
                   63)
                                                     (* Nothing except query)
               (RETURN)))
        ENTRY
            [COND
              ((EQ (PEEKC)
                   (QUOTE &))
               (TERPRI)
               (RETURN (CONS (PRIN1 (READC]
            (SETQ PTR 0)
            (SETQ BUFPTR (CONS))
        LOOP[OR (QHGET PTR 0)
                (RETURN (CONS (QHGET PTR -1)
                              (QHGET PTR -2]
            (SETQ CHAR (READC))
            (SETQ CODE (CHCON1 CHAR))
            (SETQ NEWPTR (QHGET PTR CODE))
            (COND
              (NEWPTR (PRIN1 CHAR)
                      (TCONC BUFPTR CHAR)
                      (SETQ PTR NEWPTR))
              [(MEMB CODE (GETSYNTAX (QUOTE SEPRCHAR)))
               (SETQ ITEM (QHGET PTR -1))
               (COND
                 [ITEM (PRIN1 CHAR)
                       (RETURN (CONS ITEM (QHGET PTR -2]
                 (T (BEEP]
              ((EQ CODE 63)
                                                     (* Query)
               (TERPRI)
               (PRIN1 "one of:")
               (TERPRI)
               (QHLIST PTR)
               (TERPRI)
               (MAPRINT INBUF)
               (PRIN1 " ")
               (MAPC (CAR BUFPTR)
                     (FUNCTION PRIN1)))
              ((EQ CODE 27)
                                                     (* Escape)
               (PROG (NUM)
                     (SETQ NUM (QHGET PTR 0))
```

```
                INLOOP
                    (COND
                      ((OR (NOT (NUMBERP NUM))
                           (QHGET PTR -1))
                        (COND
                          (NUM (BEEP)))
                        (RETURN)))
                    (TCONC BUFPTR (PRIN1 (CHARACTER NUM)))
                    (SETQ PTR (QHGET PTR NUM))
                    (SETQ NUM (QHGET PTR 0))
                    (GO INLOOP)))
            ((EQ CODE 127)
                                                (* Rubout)
              (TERPRI)
              (MAPRINT INBUF)
              (PRIN1 " ")
              (GO ENTRY))
            [(AND (SETQ NEWPTR (QHGET PTR 27))
                  (SETQ ITEM (QHGET NEWPTR -1)))
              (RETURN (CONS [MKATOM (CONCAT (OR (SUBSTRING ITEM 1 -2)
                                                ""))
                                            (PRIN1 CHAR)
                                            (RESETFORM (ECHOMODE
                                                         T)
                                                       (READ]
                            (QHGET NEWPTR -2]
            (T (BEEP)))
          (GO LOOP])
```

[231]

```
(BEEP
  [LAMBDA NIL                                   (* edited:
                                                "15-Jun-79 13:24")
    (PRIN1 (CHARACTER 7])
```

[232]

```
(QHTAKE
  [NLAMBDA L                                    (* edited:
                                                "12-Jul-79 19:25")
    (QHFOLLOW (CONS L)
              (CONS])
```

[233]

```
(QHFOLLOW
  [LAMBDA (LL BUFPTR QHMATCH)                   (* edited:
                                                " 1-Aug-79 19:37")
    (PROG (L X QHVAL ALIST)
      START
          [COND
            ((CDR LL)
              (SETQ QHMATCH (QHFOLLOW (CDR LL)
                                      BUFPTR QHMATCH]
          (SETQ L (CAR LL))
      LOOP(COND
```

```
        ((NULL L)
          (RETURN QHMATCH)))                    (* Default)
      (SETQ X (CAR L))
      (COND
        ((EQ X (QUOTE :))
          (RETURN (EVALA (CADR L)
                         ALIST)))
        ((EQ (CAR X)
             (QUOTE =))
          (SETQ ALIST (CONS (CONS (CADR X)
                                  QHMATCH)
                            ALIST))
          (SETQ L (CDR L))
          (GO LOOP))
        ((STRINGP X)
          [TCONC BUFPTR (PRIN1 (COND
                                 ((EQ (NTHCHAR X 1)
                                      (QUOTE -))
                                   (CONCAT (CHARACTER 8)
                                           (SUBSTRING X 2)))
                                 (T X]
          (PRIN1 " ")
          (SETQ L (CDR L))
          (GO LOOP)))
      (QHCLEAR)
      (QHPREP (CAR L)
              (CDR L))
      (QHMAKE (QUOTE ?))
QUERY
      (SETQ QHVAL (QHASK (CAR BUFPTR)))
      (COND
        ((EQ (CAR QHVAL)
             (QUOTE ?))
          (TERPRI)
          (PRIN1 "one of:")
          (TERPRI)
          (QHSHOW L)
          (TERPRI)
          (MAPRINT (CAR BUFPTR))
          (PRIN1 " ")
          (GO QUERY))
        ((EQ (CAR QHVAL)
             (QUOTE &))
          (SETQ QHVAR (READ))
          (CLEARBUF)
          [COND
            ((NOT (LISTP (EVALV QHVAR)))
              (PRIN1 "??"))
            (T (TERPRI)
               (PRIN1 "one of")
               (TERPRI)
               (QHSHOW (CONS (EVAL QHVAR]
          (TERPRI)
          (MAPRINT (CAR BUFPTR))
          (PRIN1 " ")
          (GO QUERY)))
      (SETQ QHMATCH (CAR QHVAL))
```

```
          (SETQ LL (REVERSE (CDR QHVAL)))
          (PRIN1 " ")
          (TCONC BUFPTR (CAR QHVAL))
          (GO START])
```

[234]

```
(QHPREP
  [LAMBDA (FOCUS QHLST SHOWFLG STK)                    (* edited:
                                                       " 1-Aug-79 12:17")
    (COND
      [(LISTP FOCUS)
        (COND
          ((EQ (CAR FOCUS)
               (QUOTE ~))
            (QHPREP (CDR FOCUS)
                    QHLST SHOWFLG STK)
            (QHPREP (CAR QHLST)
                    (CDR QHLST)
                    SHOWFLG STK))
          (T (MAPC FOCUS (FUNCTION (LAMBDA (F)
                           (QHPREP F QHLST SHOWFLG STK]
      [(AND (EQ (NTHCHAR FOCUS 1)
                (QUOTE <))
            (EQ (NTHCHAR FOCUS -1)
                (QUOTE >)))
        (MAPC (OR (GETPROP FOCUS (QUOTE QHPRODS))                    |
                  (HELP "No productions for" FOCUS))                 |
              (FUNCTION (LAMBDA (X)
                  (QHPREP (CAR X)
                          (CDR X)
                          SHOWFLG
                          (CONS QHLST STK]
      (T (QHMAKE FOCUS (CONS QHLST STK)
                SHOWFLG])
```

[235]

```
(QHSHOW
  [LAMBDA (L)                                          (* edited:
                                                       "13-Jul-79 16:23")
    (QHPREP (CAR L)                                                  |
            (CDR L)                                                  |
            T])
)
(DECLARE: DONTEVAL@LOAD DOEVAL@COMPILE DONTCOPY COMPILERVARS

(ADDTOVAR NLAMA QHTAKE PQ)

(ADDTOVAR NLAML )

(ADDTOVAR LAMA )
)
(DECLARE: DONTCOPY
  (FILEMAP (NIL (727 8025 (PQ 739 . 965) (QHCLEAR 969 . 1120) (QHMAKE 1124
 . 2309) (QHLIST 2313 . 2883) (QHASK 2887 . 5007) (BEEP 5011 . 5130) (
QHTAKE 5134 . 5268) (QHFOLLOW 5272 . 7119) (QHPREP 7123 . 7851) (QHSHOW
```

```
7855 . 8022)))))
STOP
```

```
(FILECREATED "27-Aug-79 21:39:40" <RBECHTAL>RULES..29 16305

     changes to:  (MATCH-PLAT CONDITIONS)

     previous date: "27-Aug-79 18:40:58" <RBECHTAL>RULES..28)


(PRETTYCOMPRINT RULESCOMS)

(RPAQQ RULESCOMS ((VARS * RULESVARS)
                  (FNS * RULESFNS)
                  (PROP (CONDITIONS ACTIONS CONF)
                        * PRODUCTIONS)))

(RPAQQ RULESVARS (PRODUCTIONS))

(RPAQQ PRODUCTIONS (INHERIT NOT-LAST-SIGHTING NOT-FIRST-SIGHTING
                            FIRST-VIEW NOT-KNOWN-COMBATANT REACHABLE
                            SIMPLY-REACHABLE POSS-RPT BLOCKER
                            CREATEDETECT CREATECONTACT CREATEPLAT
                            SMALL-CRAFT9 SMALL-CRAFT6 SMALL-CRAFT5
                            SMALL-CRAFT4 SMALL-CRAFT3 SMALL-CRAFT2
                            SMALL-CRAFT1 ID-LANE INSIDE-A-STORM
                            CLOSE-POPUP DISTANT-POPUP COURSE-CHANGED
                            SPEED-CHANGED FASTER-THAN-A-MERCHANT
                            SLOWER-THAN-A-MERCHANT MATCH-PLAT
                            OUTSIDE-ALL-LANES))

(RPAQQ RULESFNS (DEFINEPD MAKEPD FANCYPROD LINEREAD))
(DEFINEQ

                                                              [236]

(DEFINEPD
  [LAMBDA NIL                                          (* edited:
                                                       "27-Jun-79 17:33")
    (PROG (PDNAME NEWCON CONDS NEWACT ACT CONFID)

          (* DEFINEPD provides a "nice" user interface for
          production rule definition, by prompting for needed
          information.)


          (PRIN1 "NAME? ")
          (SETQ PDNAME (CAR (LINEREAD)))
          (PRIN1 "CONDITIONS? ")
      DPD1(COND
            ((SETQ NEWCON (LINEREAD))
              (SETQ CONDS (APPEND CONDS NEWCON))
              (GO DPD1)))
          (PRIN1 "ACTION? ")
      DPD2(COND
            ((SETQ NEWACT (LINEREAD))
              (SETQ ACT (APPEND ACT NEWACT))
              (GO DPD2)))
          (PRIN1 "CONFIDENCE? ")
```

```
          (SETQ CONFID (CAR (LINEREAD)))
          (MAKEPD PDNAME CONDS ACT CONFID])
```

[237]

```
(MAKEPD
  [LAMBDA (NAM CO AC TRUST)                    (* edited:
                                               "27-Jun-79 10:26")
    (PROG NIL

          (* MAKEPD does the actual construction of
          productions. The elements of a production are stored
          on the property list of the production name.)


          (PUTPROP NAM (QUOTE CONDITIONS)
                  CO)
          (PUTPROP NAM (QUOTE ACTIONS)
                  AC)
          (PUTPROP NAM (QUOTE CONF)
                  TRUST)
          (SETQ PRODUCTIONS (CONS NAM PRODUCTIONS))
          (RETURN NAM])
```

[238]

```
(FANCYPROD
  [LAMBDA (PRO)                                (* edited:
                                               "27-Aug-79 17:18")
                                               (* FANCYPROD is a
                                               prettyprinter for
                                               productions.)
    (PRIN1 "NAME: ")
    (PRIN1 PRO)
    (TERPRI)
    (TERPRI)
    (PRIN1 "CONDITIONS:")
    (TERPRI)
    [PROG [(C (GETPROP PRO (QUOTE CONDITIONS]
      LOOOP
          (COND
            ((NULL C)
              (RETURN))
            (T (SELECTQ (CAAR C)
                        (*UNLESS* (PRETTYASSR (CADAR C)
                                              NIL 0.0))
                        (*NOT* (PRETTYASSR (CADAR C)
                                           NIL -1.0))
                        [*OR* (PRINT (QUOTE *OR*))
                              (MAPC (CDAR C)
                                    (FUNCTION (LAMBDA (X)
                                        (TAB 3)
                                        (PRETTYASSR X]
                        (PRETTYASSR (CAR C)))
               (SETQ C (CDR C))
               (GO LOOOP]
    (TERPRI)
```

```
    (PRIN1 "ACTION:")
    (TERPRI)
    [PROG [(A (GETPROP PRO (QUOTE ACTIONS]
      ALP (COND
            ((NULL A)
              (RETURN))
            (T [COND
                 [(EQ (CAAR A)                                    |
                      (QUOTE *OR*))                               |
                   (PRIN1 "Either")                               |
                   (TERPRI)                                       |
                   (MAPC (CDAR A)                                 |
                         (FUNCTION (LAMBDA (CART)                 |
                             (TAB 5)                              |
                             (COND                                |
                               [(LISTP (CAR CART))                |
                                 (PRETTYASSR (CAR CART))          |
                                 (MAPC (CDR CART)                 |
                                       (FUNCTION (LAMBDA (CARTEL) |
                                           (PRIN1 " and ")        |
                                           (PRETTYASSR CARTEL]    |
                               (T (PRETTYASSR CART]               |
                  (T (PRETTYASSR (CAR A]
                (SETQ A (CDR A))
                (GO ALP]
    (TERPRI)
    (PRIN1 "CONFIDENCE: ")
    (PRIN1 (GETPROP PRO (QUOTE CONF)))
    (TERPRI)
    (TERPRI])
```

[239]

```
(LINEREAD
  [LAMBDA NIL                                          (* NOBIND
                                                       "22-Dec-78 12:27")

        (* LINEREAD reads a line, terminated by a CR, right
        paren, or right square bracket.
        The normal LISP READLINE makes some inconvenient
        assuptions about typeahead, which this doesn't.)


    (OR (READP T)
        (BKLINBUF " "))
    (READLINE])
)

(RPAQQ PRODUCTIONS (INHERIT NOT-LAST-SIGHTING NOT-FIRST-SIGHTING
                            FIRST-VIEW NOT-KNOWN-COMBATANT REACHABLE
                            SIMPLY-REACHABLE POSS-RPT BLOCKER
                            CREATEDETECT CREATECONTACT CREATEPLAT
                            SMALL-CRAFT9 SMALL-CRAFT6 SMALL-CRAFT5
                            SMALL-CRAFT4 SMALL-CRAFT3 SMALL-CRAFT2
                            SMALL-CRAFT1 ID-LANE INSIDE-A-STORM
                            CLOSE-POPUP DISTANT-POPUP COURSE-CHANGED
                            SPEED-CHANGED FASTER-THAN-A-MERCHANT
```

```
                                SLOWER-THAN-A-MERCHANT MATCH-PLAT
                                OUTSIDE-ALL-LANES))

(PUTPROPS INHERIT CONDITIONS ((ALIAS *PLAT *UNKNOWN)
                              (TYPE *PLAT *TYP)
                              (ID *PLAT *ID1)
                              (ID-AMPLIFY *PLAT *IDMP)
                              (CLASS *PLAT *CLS)
                              (MEDIUM *PLAT *MED)))

(PUTPROPS NOT-LAST-SIGHTING CONDITIONS ((SIGHTING *PLAT *S1)
                                        (SIGHTING *PLAT *S2)
                                        (*NOT* (SAME-AS *S1 *S2))
                                        (TOS *S1 *T1)
                                        (TOS *S2 *T2)
                                        (LESS-THAN *T1 *T2)
                                        (*UNLESS* (NOT-LAST *S1))))

(PUTPROPS NOT-FIRST-SIGHTING CONDITIONS ((SIGHTING *PLAT *S1)
                                         (SIGHTING *PLAT *S2)
                                         (*NOT* (SAME-AS *S1 *S2))
                                         (TOS *S1 *T1)
                                         (TOS *S2 *T2)
                                         (LESS-THAN *T2 *T1)
                                         (*UNLESS* (NOT-FIRST *S1))))

(PUTPROPS FIRST-VIEW CONDITIONS ((SIGHTING *PLAT *S1)
                                 (*UNLESS* (NOT-FIRST *S1))))

(PUTPROPS NOT-KNOWN-COMBATANT CONDITIONS ((CONTACT *CONT)
                                          (SIGHTING *CONT *S1)
                                          (*UNLESS* (WITHIN-REACH
                                                      *S1 *S2))
                                          (SIGHTING *PLAT *S2)
                                          (ID-AMPLIFY *PLAT MIL-BATTLE)
                                          (*UNLESS* (OWNSHIP *PLAT))))

(PUTPROPS REACHABLE CONDITIONS ((CONTACT *CONT)
                                (SIGHTING *CONT *S1)
                                (SIGHTING *PLAT *S2)
                                (*NOT* (SAME-AS *PLAT *CONT))
                                (*UNLESS* (OWNSHIP *PLAT))
                                (SIMPLY-WITHIN-REACH *S1 *S2)
                                (*UNLESS* (BLOCKED-FROM *S1 *S2))))

(PUTPROPS SIMPLY-REACHABLE CONDITIONS ((CONTACT *CONT)
                                       (SIGHTING *CONT *S1)
                                       (SIGHTING *PLAT *S2)
                                       (ID-AMPLIFY *PLAT MIL-BATTLE)
                                       (*NOT* (SAME-AS *CONT *PLAT))
                                       (*UNLESS* (OWNSHIP *PLAT))
                                       (POSITION *S1 *P1)
                                       (POSITION *S2 *P2)
                                       (TOS *S1 *T1)
                                       (TOS *S2 *T2)
                                       (SWR *P1 *T1 *P2 *T2)))
```

```
(PUTPROPS POSS-RPT CONDITIONS ((PATROL *PTL)
                               (CONTACT *CONT)
                               (SIGHTING *CONT *S1)
                               (SIGHTING *PLAT *S2)
                               (ID-AMPLIFY *PLAT MIL-BATTLE)
                               (*UNLESS* (OWNSHIP *PLAT))
                               (SOURCE *S2 *PTL)
                               (*NOT* (SAME-AS *S1 *S2))
                               (*UNLESS* (DISSIMILAR *CONT *PLAT))))

(PUTPROPS BLOCKER CONDITIONS ((CONTACT *CONT)
           (SIGHTING *CONT *S1)
           (SIGHTING *PLAT *S2)
           (ID-AMPLIFY *PLAT MIL-BATTLE)
           (*NOT* (SAME-AS *CONT *PLAT))
           (*UNLESS* (OWNSHIP *PLAT))
           (PATROL *PTL)
           (*UNLESS* (POSSIBLE-REPORT *CONT *PTL))
           (SIGHTING *PTL *S3)
           (NOT-LAST *S3)
           (SUCCESSOR *S3 *S4)
           (POSITION *S1 *P1)
           (POSITION *S2 *P2)
           (POSITION *S3 *P3)
           (POSITION *S4 *P4)
           (TOS *S1 *T1)
           (TOS *S2 *T2)
           (TOS *S3 *T3)
           (TOS *S4 *T4)
           (*OR* (CROSSPATHS *P1 *P2 *P3 *P4)
                 (GRAZE *P1 *P2 *P3 *P4))
           (*NOT* (WENT-BEFORE *P1 *T1 *P2 *T2 *P3 *T3 *P4 *T4))
           (*NOT* (WENT-AFTER *P1 *T1 *P2 *T2 *P3 *T3 *P4 *T4))))

(PUTPROPS CREATEDETECT CONDITIONS ((SIGHTING *PLAT *SGT)
                                   (SOURCE *SGT EW)
                                   (*UNLESS* (DETECTION *PLAT))))

(PUTPROPS CREATECONTACT CONDITIONS ((SIGHTING *PLAT *SGT)
                                    (SOURCE *SGT RADAR)
                                    (*UNLESS* (CONTACT *PLAT))))

(PUTPROPS CREATEPLAT CONDITIONS ((SIGHTING *PLAT *SGT)
                                 (*UNLESS* (OWNSHIP *PLAT))
                                 (*UNLESS* (PLATFORM *PLAT))))

(PUTPROPS SMALL-CRAFT9 CONDITIONS ((CONTACT *WHO)
                                   (FIRST-SIGHTING *WHO *S1)
                                   (SOURCE *S1 RADAR)
                                   (RANGE *S1 *R1)
                                   (LESS-THAN *R1 8)
                                   (STRENGTH *S1 STRONG)))

(PUTPROPS SMALL-CRAFT6 CONDITIONS ((CONTACT *X)
                                   (SIGHTING *X *SIGHT)
                                   (NOT-FIRST *SIGHT)
                                   (RANGE *SIGHT *R)
```

```
                                    (LESS-THAN *R 16)
                                    (GREATER-THAN *R 9)
                                    (STRENGTH *SIGHT WEAK)
                                    (SPEED *SIGHT *SPD)
                                    (*UNLESS* (GREATER-THAN *SPD 20))))

(PUTPROPS SMALL-CRAFT5 CONDITIONS ((CONTACT *WHO)
                                    (SIGHTING *WHO *S1)
                                    (NOT-FIRST *S1)
                                    (SOURCE *S1 RADAR)
                                    (RANGE *S1 *RANGE)
                                    (LESS-THAN *RANGE 16)
                                    (GREATER-THAN *RANGE 9)
                                    (STRENGTH *S1 WEAK)
                                    (SPEED *S1 *SPEED)
                                    (GREATER-THAN *SPEED 20)))

(PUTPROPS SMALL-CRAFT4 CONDITIONS ((CONTACT *UNKNOWN)
                                    (SIGHTING *UNKNOWN *SIGHTING1)
                                    (LAND-DIST *SIGHTING1 *DIST)
                                    (SOURCE *SIGHTING1 RADAR)
                                    (RANGE *SIGHTING1 *RANGE)
                                    (LESS-THAN *RANGE 9)
                                    (GREATER-THAN *RANGE 3)
                                    (STRENGTH *SIGHTING1 WEAK)
                                    (LESS-THAN *DIST 50)))

(PUTPROPS SMALL-CRAFT3 CONDITIONS ((CONTACT *UNKNOWN)
                                    (SIGHTING *UNKNOWN *SIGHTING)
                                    (LAND-DIST *SIGHTING *DIST)
                                    (SOURCE *SIGHTING RADAR)
                                    (RANGE *SIGHTING *RANGE)
                                    (LESS-THAN *RANGE 9)
                                    (GREATER-THAN *RANGE 3)
                                    (STRENGTH *SIGHTING WEAK)
                                    (GREATER-THAN *DIST 50)))

(PUTPROPS SMALL-CRAFT2 CONDITIONS ((CONTACT *UNKNOWN)
                                    (SIGHTING *UNKNOWN *SIGHTING)
                                    (NOT-FIRST *SIGHTING)
                                    (SOURCE *SIGHTING RADAR)
                                    (STRENGTH *SIGHTING WEAK)
                                    (SPEED *SIGHTING *SPEED)
                                    (*UNLESS* (GREATER-THAN *SPEED 3))))

(PUTPROPS SMALL-CRAFT1 CONDITIONS ((CONTACT *UNKNOWN)
                                    (SIGHTING *UNKNOWN *SIGHTING)
                                    (NOT-FIRST *SIGHTING)
                                    (SOURCE *SIGHTING RADAR)
                                    (RANGE *SIGHTING *RANGE)
                                    (LESS-THAN *RANGE 3)
                                    (STRENGTH *SIGHTING WEAK)
                                    (SPEED *SIGHTING *SPEED)
                                    (GREATER-THAN *SPEED 3)))

(PUTPROPS ID-LANE CONDITIONS ((SIGHTING *SHIP *SIGHTING)
                              (MERCHANTLANE *LANE)
```

```
                                (PLATFORM *SHIP)
                                (LOCATION *LANE *LANELOC)
                                (POSITION *SIGHTING *POS)
                                (IN-LANE *LANELOC *POS)))

(PUTPROPS INSIDE-A-STORM CONDITIONS ((SIGHTING *SHIP *SIGHTING)
                                     (PLATFORM *SHIP)
                                     (STORM *STORM)
                                     (POSITION *SIGHTING *POS)
                                     (LOCATION *STORM *STMLOC)
                                     (INSIDE *POS *STMLOC)))

(PUTPROPS CLOSE-POPUP CONDITIONS ((CONTACT *SHIP)
                                  (FIRST-SIGHTING *SHIP *SIGHTING)
                                  (RANGE *SIGHTING *RANGE)
                                  (LESS-THAN *RANGE 12)))

(PUTPROPS DISTANT-POPUP CONDITIONS ((CONTACT *SHIP)
                                    (FIRST-SIGHTING *SHIP *SIGHTING)
                                    (RANGE *SIGHTING *RANGE)
                                    (GREATER-THAN *RANGE 30)))

(PUTPROPS COURSE-CHANGED CONDITIONS ((CONTACT *SHIP)
                                     (SIGHTING *SHIP *SIGHTING1)
                                     (NOT-FIRST *SIGHTING1)
                                     (NOT-LAST *SIGHTING1)
                                     (SUCCESSOR *SIGHTING1 *SIGHTING2)
                                     (COURSE *SIGHTING1 *COURSE1)
                                     (COURSE *SIGHTING2 *COURSE2)
                                     (*UNLESS* (
ROUGHLY-THE-SAME-COURSE-AS *COURSE1 *COURSE2))))

(PUTPROPS SPEED-CHANGED CONDITIONS ((CONTACT *SHIP)
                                    (SIGHTING *SHIP *SIGHTING)
                                    (NOT-FIRST *SIGHTING)
                                    (NOT-LAST *SIGHTING)
                                    (SUCCESSOR *SIGHTING *SIGHTING2)
                                    (SPEED *SIGHTING *SPEED1)
                                    (SPEED *SIGHTING2 *SPEED2)
                                    (*UNLESS* (ROUGHLY-THE-SAME-SPEED-AS
                                               *SPEED1 *SPEED2))))

(PUTPROPS FASTER-THAN-A-MERCHANT CONDITIONS ((CONTACT *SHIP)
                                             (SIGHTING *SHIP *SIGHTING)
                                             (NOT-FIRST *SIGHTING)
                                             (SPEED *SIGHTING *SPEED)
                                             (GREATER-THAN *SPEED 25)))

(PUTPROPS SLOWER-THAN-A-MERCHANT CONDITIONS ((CONTACT *SHIP)
                                             (SIGHTING *SHIP *SIGHTING)
                                             (NOT-FIRST *SIGHTING)
                                             (SPEED *SIGHTING *SPEED)
                                             (LESS-THAN *SPEED 9)))

(PUTPROPS MATCH-PLAT CONDITIONS ((SIGHTING *PLAT1 *SGT1)
                                 (NOT-FIRST *SGT1)
                                 (SIGHTING *PLAT2 *SGT2)
```

```
                                        (*NOT* (SAME-AS *PLAT1 *PLAT2))
                                        (*UNLESS* (NOT-LAST *SGT2))
                                        (COURSE *SGT1 *CRS1)
                                        (SPEED *SGT1 *SPD1)
                                        (POSITION *SGT1 *POS1)
                                        (TOS *SGT1 *T1)
                                        (POSITION *SGT2 *POS2)
                                        (TOS *SGT2 *T2)
                                        (LESS-THAN *T2 *T1)
                                        (COURSEFROM *POS2 *POS1 *CRS2)
                                        (SPEEDFROM *POS2 *T2 *POS1 *T1 *SPD2)
                                        (ROUGHLY-THE-SAM-COURSE-AS *CRS1 *CRS2)
                                        (ROUGHLY-THE-SAME-SPEED-AS *SPD1 *SPD2)
                                        ))

(PUTPROPS OUTSIDE-ALL-LANES CONDITIONS ((SIGHTING *SHIP *SIGHTING)
                                        (PLATFORM *SHIP)
                                        (*UNLESS* (MEDIUM *SHIP AIR))
                                        (*UNLESS* (INSIDE-A-MERCHANTLANE
                                                   *SIGHTING))))

(PUTPROPS INHERIT ACTIONS ((TYPE *UNKNOWN *TYP)
                           (ID *UNKNOWN *ID1)
                           (ID-AMPLIFY *UNKNOWN *IDMP)
                           (CLASS *UNKNOWN *CLS)
                           (MEDIUM *UNKNOWN *MED)))

(PUTPROPS NOT-LAST-SIGHTING ACTIONS ((NOT-LAST *S1)))

(PUTPROPS NOT-FIRST-SIGHTING ACTIONS ((NOT-FIRST *S1)))

(PUTPROPS FIRST-VIEW ACTIONS ((FIRST-SIGHTING *PLAT *S1)))

(PUTPROPS NOT-KNOWN-COMBATANT ACTIONS ((TYPE *CONT MERCHANT)))

(PUTPROPS REACHABLE ACTIONS ((WITHIN-REACH *S1 *S2)))

(PUTPROPS SIMPLY-REACHABLE ACTIONS ((SIMPLY-WITHIN-REACH *S1 *S2)))

(PUTPROPS POSS-RPT ACTIONS ((POSSIBLE-REPORT *CONT *PTL)))

(PUTPROPS BLOCKER ACTIONS ((BLOCKED-FROM *S1 *S2)))

(PUTPROPS CREATEDETECT ACTIONS ((DETECTION *PLAT)))

(PUTPROPS CREATECONTACT ACTIONS ((CONTACT *PLAT)))

(PUTPROPS CREATEPLAT ACTIONS ((PLATFORM *PLAT)))

(PUTPROPS SMALL-CRAFT9 ACTIONS ((TYPE *WHO SUB)
                                (MODE *WHO SURFACE)))

(PUTPROPS SMALL-CRAFT6 ACTIONS [(*OR* (TYPE *X FISHING)
                                      (TYPE *X PATROL)
                                      ((TYPE *X SUB)
                                       (MODE *X SURFACE])
```

```
(PUTPROPS SMALL-CRAFT5 ACTIONS ((*OR* (TYPE *WHO SUB)
                                      (TYPE *WHO PATROL))))

(PUTPROPS SMALL-CRAFT4 ACTIONS ((*OR* (TYPE *UNKNOWN SUB)
                                      (TYPE *UNKNOWN SHORE-PATROL)
                                      (TYPE *UNKNOWN PLEASURE)
                                      (TYPE *UNKNOWN COMMERCIAL)
                                      (TYPE *UNKNOWN LANDING))))

(PUTPROPS SMALL-CRAFT3 ACTIONS ((TYPE *UNKNOWN SUB)))

(PUTPROPS SMALL-CRAFT2 ACTIONS ((*OR* (TYPE *UNKNOWN DEBRIS)
                                      (TYPE *UNKNOWN SUB)
                                      (TYPE *UNKNOWN BUOY))))

(PUTPROPS SMALL-CRAFT1 ACTIONS ((TYPE *UNKNOWN SUB)
                                (*OR* (MODE *UNKNOWN PERISCOPE)
                                      (MODE *UNKNOWN SNORKEL))))

(PUTPROPS ID-LANE ACTIONS ((INSIDE-A-MERCHANTLANE *SIGHTING)
                           (*REPORT* *SHIP
                               " was sighted in the merchant lane "
                                    *LANE)))

(PUTPROPS INSIDE-A-STORM ACTIONS ((TYPE *SHIP MERCHANT)
                                  (*REPORT* *SHIP
                                            " was sighted inside "
                                            *STORM)))

(PUTPROPS CLOSE-POPUP ACTIONS ((TYPE *SHIP MERCHANT)))

(PUTPROPS DISTANT-POPUP ACTIONS ((TYPE *SHIP MERCHANT)))

(PUTPROPS COURSE-CHANGED ACTIONS ((TYPE *SHIP MERCHANT)))

(PUTPROPS SPEED-CHANGED ACTIONS ((TYPE *SHIP MERCHANT)))

(PUTPROPS FASTER-THAN-A-MERCHANT ACTIONS ((TYPE *SHIP MERCHANT)))

(PUTPROPS SLOWER-THAN-A-MERCHANT ACTIONS ((TYPE *SHIP MERCHANT)))

(PUTPROPS MATCH-PLAT ACTIONS ((ALIAS *PLAT2 *PLAT1)))

(PUTPROPS OUTSIDE-ALL-LANES ACTIONS ((TYPE *SHIP MERCHANT)))

(PUTPROPS INHERIT CONF 1.0)

(PUTPROPS NOT-LAST-SIGHTING CONF 1.0)

(PUTPROPS NOT-FIRST-SIGHTING CONF 1.0)

(PUTPROPS FIRST-VIEW CONF .99)

(PUTPROPS NOT-KNOWN-COMBATANT CONF .45)

(PUTPROPS REACHABLE CONF .97)
```

```
(PUTPROPS SIMPLY-REACHABLE CONF .98)

(PUTPROPS POSS-RPT CONF .95)

(PUTPROPS BLOCKER CONF .9)

(PUTPROPS CREATEDETECT CONF 1.0)

(PUTPROPS CREATECONTACT CONF 1.0)

(PUTPROPS CREATEPLAT CONF 1.0)

(PUTPROPS SMALL-CRAFT9 CONF .5)

(PUTPROPS SMALL-CRAFT6 CONF .15)

(PUTPROPS SMALL-CRAFT5 CONF .3)

(PUTPROPS SMALL-CRAFT4 CONF .1)

(PUTPROPS SMALL-CRAFT3 CONF .35)

(PUTPROPS SMALL-CRAFT2 CONF .12)

(PUTPROPS SMALL-CRAFT1 CONF .6)

(PUTPROPS ID-LANE CONF 1.0)

(PUTPROPS INSIDE-A-STORM CONF -.25)

(PUTPROPS CLOSE-POPUP CONF -.2)

(PUTPROPS DISTANT-POPUP CONF -.2)

(PUTPROPS COURSE-CHANGED CONF -.3)

(PUTPROPS SPEED-CHANGED CONF -.3)

(PUTPROPS FASTER-THAN-A-MERCHANT CONF -.25)

(PUTPROPS SLOWER-THAN-A-MERCHANT CONF -.15)

(PUTPROPS MATCH-PLAT CONF .5)

(PUTPROPS OUTSIDE-ALL-LANES CONF -.08)
(DECLARE: DONTCOPY
  (FILEMAP (NIL (936 4519 (DEFINEPD 948 . 1975) (MAKEPD 1979 . 2509) (
FANCYPROD 2513 . 4150) (LINEREAD 4154 . 4516))))
STOP
```

```
(FILECREATED " 6-Aug-79 20:15:20" <PMORRIS>STREAM.LSP.37 7631

     changes to:  UNFREEZE

     previous date: " 6-Aug-79 14:19:01" <PMORRIS>STREAM.LSP.36)


(PRETTYCOMPRINT STREAMCOMS)

(RPAQQ STREAMCOMS ((FNS * STREAMFNS)
                   (VARS (MAPRETALIST NIL)
                         (FREEZEFLG NIL)
                         (FREEZELST NIL))))

(RPAQQ STREAMFNS (ENDSTREAM FREEZE MAPSTREAM NEWSTREAM MAPRETRIEVE
                            MAPRETDO RETPULSEDO RETRIEVES PREPALIST
                            RETSTREAM GETMRVAL SOMEPULSE STRIPSTREAM
                            PULSAR PULSE PUTSTREAM UNFREEZE))
(DEFINEQ

                                                                [240]

(ENDSTREAM
  [LAMBDA (S)                                           (* edited:
                                                        " 6-Aug-79 14:08")

          (* This has an effect like putting an end marker on
          a stream. It actually discards the suspensions and
          replaces them by the marker T, which informs
          MAPSTREAM not to place new suspensions on the
          stream.)


    (RPLACD S T])

                                                                [241]

(FREEZE
  [LAMBDA NIL                                           (* edited:
                                                        " 3-Aug-79 17:32")
    (SETQ FREEZEFLG T)
    (QUOTE Brr..])

                                                                [242]

(MAPSTREAM
  [LAMBDA (MAPSTREAMX MAPSTREAMINFO MAPSTREAMFN)
                                                        (* edited:
                                                        " 6-Aug-79 14:13")
    (PROG NIL                                                   |
          [MAPC (CAAR MAPSTREAMX)                               |
                (FUNCTION (LAMBDA (X)                           |
                    (APPLY* MAPSTREAMFN X MAPSTREAMINFO]        |
          (COND                                                 |
            ((NEQ (CDR MAPSTREAMX)                              |
                  T)                                            |
```

```
            (TCONC (CDR MAPSTREAMX)
                   (CONS MAPSTREAMINFO MAPSTREAMFN])
```

[243]

```
(NEWSTREAM
  [LAMBDA NIL                                          (* edited:
                                                       "11-Apr-79 17:09")
    (CONS (CONS)
          (CONS])
```

[244]

```
(MAPRETRIEVE
  [LAMBDA (MAPRETX MAPRETINFO MAPRETFN)                (* edited:
                                                       " 6-Jul-79 16:18")
    (MAPSTREAM (RETSTREAM MAPRETX)
               (CONS (CONS MAPRETALIST MAPRETINFO)
                     (CONS MAPRETX MAPRETFN))
               (FUNCTION MAPRETDO])
```

[245]

```
(MAPRETDO
  [LAMBDA (SELT AI)                                    (* edited:
                                                       " 6-Jul-79 16:23")
    (SOMEPULSE (GETPULSAR SELT)
               (CONS SELT AI)
               (FUNCTION RETPULSEDO])
```

[246]

```
(RETPULSEDO
  [LAMBDA (SELTAI)                                     (* edited:
                                                       " 6-Jul-79 16:43")
    (PROG ((SELT (CAR SELTAI))
           (AI (CDR SELTAI))
           ASS MAPRETALIST MAPRETINFO MAPRETX MAPRETFN)
          (DECLARE (SPECVARS MAPRETALIST))
          (SETQ ASS (GETUPLE SELT))
          (SETQ MAPRETALIST (CAAR AI))
          (SETQ MAPRETINFO (CDAR AI))
          (SETQ MAPRETX (CADR AI))
          (SETQ MAPRETFN (CDDR AI))
          (SETQ MAPRETALIST (PREPALIST MAPRETX ASS MAPRETALIST))
          (RETURN (APPLY* MAPRETFN SELT MAPRETINFO])
```

[247]

```
(RETRIEVES
  [LAMBDA (AT OBJ VAL SEL)                             (* edited:
                                                       "27-Jul-79 15:25")
    (PROG ((SPEC (QUOTE (NIL NIL NIL)))
           ASS ELT ANS LAST ONEFLG ASSES)
          (RPLACA SPEC AT)
          (RPLACA (CDR SPEC)
                  OBJ)
```

```
          [COND
            (VAL (RPLACA (CDDR SPEC)
                         VAL))
            (T (SETQ LAST (LAST SPEC))
               (RPLACD (CDR SPEC]
          [OR SEL (SETQ SEL (COND
                  ((EQ AT (QUOTE *))
                    1)
                  ((EQ OBJ (QUOTE *))
                    2)
                  ((EQ VAL (QUOTE *))
                    3)
                  (T 2]
          (SETQ ASSES (STRIPSTREAM (GETSH SPEC)))
          [COND
            [(ILESSP (for X in SPEC count (EQ X (QUOTE *)))
                     2)
              (SETQ ANS (for ASS in ASSES
                           collect (CAR (NTH (GETUPLE ASS)
                                             SEL]
            (T (for ASS in ASSES do (SETQ ELT
                                      (CAR (NTH (GETUPLE ASS)
                                                SEL)))
                                    (COND
                                      ((NOT (MEMBER ELT ANS))
                                        (SETQ ANS (CONS ELT ANS]
          (OR VAL (NCONC SPEC LAST))
          (RETURN ANS])
```

[248]

```
(PREPALIST
  [LAMBDA (CON ASS ALIST)                          (* edited:
                                                   " 6-Jul-79 17:55")
    (for C in CON as A in ASS do [COND
                                   ((AND (VAR? C)
                                         (NOT (ASSOC C ALIST)))
                                     (SETQ ALIST
                                       (CONS (CONS C A)
                                             ALIST]
       finally (RETURN ALIST])
```

[249]

```
(RETSTREAM
  [LAMBDA (C)                                      (* edited:
                                                   "29-Jun-79 15:44")

          (* This function returns the stream corresponding to
          a rule condition. It constructs a specification from
          the condition, taking into account the variable
          bindings. It reuses a scratchlist
          (of 10 elements) for efficiency, chopping off the
          piece that it doesn't need. After the stream is
          obtained, the scratchlist is restored to full size.)
```

```
    (PROG ((SCRATCH (QUOTE (0 0 0 0 0 0 0 0 0 0)))
           PTR FOLLOW S XASSOC)
          (SETQ PTR SCRATCH)
          [MAPC C (FUNCTION (LAMBDA (X)
                    (RPLACA PTR (COND
                                  [(VAR? X)
                                    (SETQ XASSOC (ASSOC X MAPRETALIST))
                                    (COND
                                      (XASSOC (CDR XASSOC))
                                      (T (QUOTE *]
                                  (T X)))
                    (SETQ FOLLOW PTR)
                    (SETQ PTR (CDR PTR]
          (RPLACD FOLLOW NIL)
          (SETQ S (GETSH SCRATCH))
          (RPLACD FOLLOW PTR)
          (RETURN S])
```

[250]

```
(GETMRVAL
  [LAMBDA (X COPYFLG)                                    (* edited:
                                                         "25-Jul-79 13:49")
    (SUBLIS MAPRETALIST X COPYFLG])
```

[251]

```
(SOMEPULSE
  [LAMBDA (PULSAR PULSARDATA SOMEPULSEFN)                (* edited:
                                                         " 5-Jul-79 19:06")
    (OR (APPLY* SOMEPULSEFN PULSARDATA)
        (TCONC PULSAR (CONS SOMEPULSEFN PULSARDATA])
```

[252]

```
(STRIPSTREAM
  [LAMBDA (S)                                            (* edited:
                                                         "29-Jun-79 17:52")
    (CAAR S])
```

[253]

```
(PULSAR
  [LAMBDA NIL                                            (* edited:
                                                         " 5-Jul-79 18:49")
    (CONS])
```

[254]

```
(PULSE
  [LAMBDA (PULSAR)                                       (* edited:
                                                         " 6-Jul-79 13:17")
    (PROG ((CELL (CONSTANT (CONS)))
           PTR)
          (SETQ PTR (RPLACD CELL (CAR PULSAR)))
      LOOP(COND
            [(NULL (CDR PTR))
```

```
              (RPLACA PULSAR (CDR CELL))
              (RPLACD PULSAR (COND
                        ((CAR PTR)
                          PTR]
             (T [COND
                  ((APPLY* (CAADR PTR)
                           (CDADR PTR))
                    (RPLACD PTR (CDDR PTR)))
                  (T (SETQ PTR (CDR PTR]
                (GO LOOP])
```

[255]

```
(PUTSTREAM
  [LAMBDA (S X)                                        (* edited:
                                                       " 6-Aug-79 14:18")
    (COND
      ((EQ (CDR S)
           T)
        (HELP "Can't put into ended stream - PUTSTREAM")))
    (TCONC (CAR S)
           X)
    (MAPC (CADR S)
          (FUNCTION (LAMBDA (SUSP)
              (COND
                (FREEZEFLG (SETQ FREEZELST (CONS (CONS X SUSP)
                                                 FREEZELST)))
                (T (APPLY* (CDR SUSP)
                           X
                           (CAR SUSP])
```

[256]

```
(UNFREEZE
  [LAMBDA NIL                                          (* edited:
                                                       " 6-Aug-79 20:15")
    (SETQ FREEZEFLG NIL)
    [MAPC (DREVERSE FREEZELST)
          (FUNCTION (LAMBDA (XSUSP)
              (APPLY* (CDDR XSUSP)
                      (CAR XSUSP)
                      (CADR XSUSP]
    (SETQ FREEZELST NIL)
    (QUOTE Ahh..])
)

(RPAQ MAPRETALIST NIL)

(RPAQ FREEZEFLG NIL)

(RPAQ FREEZELST NIL)
(DECLARE: DONTCOPY
  (FILEMAP (NIL (526 7533 (ENDSTREAM 538 . 894) (FREEZE 898 . 1036) (
MAPSTREAM 1040 . 1535) (NEWSTREAM 1539 . 1666) (MAPRETRIEVE 1670 . 1913)
 (MAPRETDO 1917 . 2128) (RETPULSEDO 2132 . 2803) (RETRIEVES 2807 . 4155)
 (PREPALIST 4159 . 4526) (RETSTREAM 4530 . 5535) (GETMRVAL 5539 . 5681)
(SOMEPULSE 5685 . 5870) (STRIPSTREAM 5874 . 5988) (PULSAR 5992 . 6099) (
```

```
PULSE 6103 . 6750) (PUTSTREAM 6754 . 7211) (UNFREEZE 7215 . 7530)))))
STOP
```

```
(FILECREATED "21-Aug-79 11:08:04" <RBECHTAL>TOPLEVEL..13 6972

     changes to:  WELCOME

     previous date: " 9-Aug-79 13:23:33" <RBECHTAL>TOPLEVEL..12)


(PRETTYCOMPRINT TOPLEVELCOMS)

(RPAQQ TOPLEVELCOMS ((VARS * TOPLEVELVARS)
                     (FNS * TOPLEVELFNS)
                     (P (MINFS 512 2))))

(RPAQQ TOPLEVELVARS (RESULTLIST DUALFLG))

(RPAQQ RESULTLIST NIL)

(RPAQQ DUALFLG NIL)

(RPAQQ TOPLEVELFNS (ADDIS CKCONFIGURATION EXLOOP INCLUDEPLAT PARTING
                          STAMMER STARTUP STUFFLN WAITER WELCOME))
(DEFINEQ
```

[257]

```
(ADDIS
  [LAMBDA (SN)                                          (* edited:
                                                        " 6-Aug-79 13:44")
                                                        (* ATTIS places a single
                                                        sighting of a platform
                                                        into the display file.)
    (PROG ((PLT (GETATTB (QUOTE SIGHTING)
                         SN))
           (POS (GETATT (QUOTE POSITION)
                        SN))
           (TIM (GETATT (QUOTE TOS)
                        SN)))
          (DISPLAY PLT (CAAR POS)
                   (CADAR POS)
                   TIM])
```

[258]

```
(CKCONFIGURATION
  [LAMBDA NIL                                           (* edited:
                                                        "31-Jul-79 16:23")
    (PROG NIL                                           (* CKCONFIGURATION
                                                        determines the terminal
                                                        configuration and
                                                        initializes the display
                                                        routines.)

          (COND
            ((TEKTEST)
              (DSPGRAB)
              (DSPINIT)
              (PRIN1 "Do you want a map? ")
```

```
            (COND
              ((EQP (CHCONl (ASKUSER))
                    89)
               (DSPMAP)))
            (CLEARBUF)
            (SETQ DSPLAYFLG T)
            (STARTUP))
           (T (PRINl "Do you have a Tektronix available for display? ")
              (COND
                ((EQP (CHCONl (ASKUSER))
                      89)
                 (CLEARBUF)
                 (SETQ DUALFLG T)
                 (PRINl "What is the Tek terminal number? ")
                 (OR (DSPGRAB (READ))
                     (HELP "Failed to initialize display terminal: "
                           (DSPTTYSTR)))
                 (CLEARBUF)
                 (DSPINIT)
                 (PRINl "Do you want a map? ")
                 (COND
                   ((EQP (CHCONl (ASKUSER))
                         89)
                    (DSPMAP)))
                 (CLEARBUF)
                 (SETQ DSPLAYFLG T)
                 (STARTUP))
                (T (CLEARBUF])
```

[259]

```
(EXLOOP
  [LAMBDA NIL                                          (* edited:
                                                       " 6-Aug-79 13:22")

          (* EXLOOP is where all the real work gets done.
          MSGMTR reads messages and places them into memory,
          and returns an indication of what should be done
          next. Unless MSGMTR returns NIL
          (out of messages) or IGNORE
          (uninteresting), the results of any rule firings are
          printed, and the explanation system is called.
          Notice that with the stream oriented rule
          interpreter, there is no distinct
          "rule interpretation" cycle or function call.)


    (PROG (MSGFLG)
      EXLP(SETQ MSGFLG (MSGMTR))
          (COND
            ((EQ MSGFLG (QUOTE IGNORE))
              (GO EXLP))
            (MSGFLG (RESOUT)
                    (EXPLAIN)
                    (GO EXLP))
            (T (RETURN])
```

[260]

```
(INCLUDEPLAT
  [LAMBDA (PNE)                                          (* edited:
                                                         " 6-Aug-79 13:24")

          (* This places any previously existing platform
          sightings into the display file.
          Used for initialization for "snapshot" memories.)


    (MAPC (RETRIEVES (QUOTE SIGHTING)
                     PNE
                     (QUOTE *)
                     3)
          (FUNCTION ADDIS])
```

[261]

```
(PARTING
  [LAMBDA NIL                                            (* edited:
                                                         " 6-Aug-79 13:25")

          (* PARTING cleans up after a STAMMER run.
          Kills the display job (if any), and notifies the
          user of the end of run.)


    (PRIN1 " Thank you for your interest in the STAMMER system.")
    (TERPRI)
    (COND
      (DSPLAYFLG (FKKILL)
                 (DSPRELD])
```

[262]

```
(STAMMER
  [LAMBDA NIL                                            (* edited:
                                                         " 6-Aug-79 13:27")

          (* This is it! Start rule interpretation by doing an
          APPLYRULE to all the rules, greet the user, do
          EXLOOP, and leave. Simplicity itself.)


    (MAPC PRODUCTIONS (FUNCTION APPLYRULE))
    (WELCOME)
    (EXLOOP)
    PARTING])
```

[263]

```
(STARTUP
  [LAMBDA NIL                                            (* edited:
                                                         " 6-Aug-79 13:35")

          * STARTUP calls functions to place existing
```

```
        platforms and merchantlanes into the display file,
        as appropriate. Particularly oriented for
        intermediate memory saves.)


    (MAPC (RETRIEVES (QUOTE PLATFORM)
                     (QUOTE *)
                     NIL 2)
          (FUNCTION INCLUDEPLAT))
    (MAPC (RETRIEVES (QUOTE MERCHANTLANE)
                     (QUOTE *)
                     NIL 2)
          (FUNCTION STUFFLN))
```

[264]

```
(STUFFLN
  [LAMBDA (MLN)                                    (* edited:
                                                   " 6-Aug-79 13:36")

        (* STUFFLN places all of the locations of a merchant
        lane into the display file. Like INCLUDEPLAT.)


    (DSPADDTRH MLN (QUOTE ML)
               (QUOTE XX))
    (MAPC (GETATT (QUOTE LOCATION)
                  MLN)
          (FUNCTION (LAMBDA (VER)
              (DSPADDINC MLN (CAR VER)
                         (CADR VER)
                         0.0])
```

[265]

```
(WAITER
  [LAMBDA NIL                                      (* NOBIND
                                                   "22-Dec-78 16:33")

        (* WAITER is used to introduce a user-controllable
        delay in single terminal display mode.)


    (COND
      ((NOT DUALFLG)
        (TERPRI)
        (TERPRI)
        (TERPRI)
        (TERPRI)
        (TEKWAIT)
        (ASKUSER 5 (QUOTE %
)
                 "<CR> to continue, <SPACE> to wait:"
                 (QUOTE ("
"])
```

```
(WELCOME
  [LAMBDA NIL                                          (* edited:
                                                       "21-Aug-79 11:07")

          (* WELCOME is the "first" thing that gets done when
          running STAMMER. (Actually, the rules are
          intitialized first.) It's a good place to put any
          initialization stuff. Now, it is used to allow the
          user to select a message file.)


    (PROG (NEWFL)
          (PRIN1 " Welcome to version 2 of the STAMMER TSA system.")
          (TERPRI)
          (PRIN1
     "What file would you like to take messages from?
(Default is ")
          (PRIN1 MSGFILE)
          (PRIN1 "): ")
          (SETQ NEWFL (LINEREAD))
          [COND
            ((NULL NEWFL))
            (T (SETQ MSGFILE (CAR NEWFL]
          (TERPRI)
          [MAPC ASSERTIONS (FUNCTION (LAMBDA (TB)
                    (PUTPROP TB (QUOTE TDB)
                             T]
          (CKCONFIGURATION])
)
(MINFS 512 2)
(DECLARE: DONTCOPY
  (FILEMAP (NIL (516 6933 (ADDIS 528 . 1040) (CKCONFIGURATION 1044 . 2141)
 (EXLOOP 2145 . 3082) (INCLUDEPLAT 3086 . 3527) (PARTING 3531 . 3987) (
STAMMER 3991 . 4423) (STARTUP 4427 . 5015) (STUFFLN 5019 . 5493) (WAITER
 5497 . 5877) (WELCOME 5881 . 6930)))))
STOP
```

```
1.STAMMER WELCOME CKCONFIGURATION TEKTEST PRINCHAR
2.        |       |               DSPINIT FKINIT FKRACS
3.        |       |               |       |      FKJSYS ASSEMBLE
4.        |       |               |       |      |      FKJSYSARG
5.        |       |               |       |      |      AC
6.        |       |               |       |      FKTTYSET FKJSYS {3}
7.        |       |               |       |      FKSW FKJSYS {3}
8.        |       |               |       |           FKHALT
9.        |       |               |       DSPQUIET FKCALL FKARRAYP FKSHR
10.       |       |               |       |        |      NOFORK FKINIT {2}
11.       |       |               |       |        |      FKWAIT FKJSYS {3}
12.       |       |               |       |        |      FKIDPB
13.       |       |               |       |        |      FKCALLERR
14.       |       |               |       |        |      PUTTYP
15.       |       |               |       |        |      FKSACS
16.       |       |               |       |        |      FKSW {7}
17.       |       |               |       |        |      FKACSRETURN
18.       |       |               |       |        |      FKRACS
19.       |       |               |       |        |      FKHNDL
20.       |       |               |       |        |      FKHT
21.       |       |               |       |        |      FKACS
22.       |       |               |       |        |      FKSYM FKSACS
23.       |       |               |       |        |      |      FKSW {7}
24.       |       |               |       |        |      |      FKRACS
25.       |       |               |       |        |      |      FKHT
26.       |       |               |       |        |      |      NOFORK {10}
27.       |       |               |       |        |      |      FKSYMACS
28.       |       |               |       |        |      |      FKHNDL
29.       |       |               |       |        |      |      GETRADIX50
30.       |       |               |       |        |      |      FKSYMPUT {a}
31.       |       |               |       |        |      FKCATYPE
32.       |       |               |       |        |      FKSR FKJSYS {3}
33.       |       |               |       |        |      FKARRAYTYPE
34.       |       |               |       |        |      FKSHR
35.       |       |               |       |        |      FKRTN ASSEMBLE
36.       |       |               |       |        FKJSYS {3}
37.       |       |               |       DSPBUF FKJSYS {3}
38.       |       |               |       DSPCNVRT CRUNCH
39.       |       |               |       FKSETVAL NOFORK {10}
40.       |       |               |       |        FKWAIT {11}
41.       |       |               |       |        FKSACS
42.       |       |               |       |        FKSW {7}
43.       |       |               |       |        FKACSRETURN
44.       |       |               |       |        FKHNDL
45.       |       |               |       |        FKHT
```

```
46.     |       |               |       |       FKACS
47.     |       |               |       |       FKSYM {22}
48.     |       |               |       |       FKIDPB
49.     |       |               |       FKCALL {9}
50.     |       |               |       DSPTTY FKCALL {9}
51.     |       |               |       |      FKJSYS {3}
52.     |       |               |       DSPTTYSTR DECSAMEDIGITS {b}
53.     |       |               DSPMAP FKSETVAL {39}
54.     |       |               STARTUP RETRIEVES STRIPSTREAM
55.     |       |               |       |       GETSH GETH LOCH {c}
56.     |       |               |       |       |    PUTH NEWHASH {d}
57.     |       |               |       |       |    |    LOCH {c}
58.     |       |               |       |       |    NEWSTREAM
59.     |       |               |       |       GETUPLE
60.     |       |               |       INCLUDEPLAT RETRIEVES {54}
61.     |       |               |       |           ADDIS DISPLAY {e}
62.     |       |               |       |                 GETATTB {f}
63.     |       |               |       |                 GETATT {g}
64.     |       |               |       STUFFLN DSPADDTRH FKCALL {9}
65.     |       |               |               |         DSPCNVRT {38}
66.     |       |               |               GETATT {g}
67.     |       |               |               DSPADDINC FKCALL {9}
68.     |       |               |                         DSPCNVRT {38}
69.     |       |               DSPGRAB OCTSAMEDIGITS OCTSAMEDIGITS {69}
70.     |       |               |       FKJSYS {3}
71.     |       |               DSPTTYSTR {52}
72.     |       LINEREAD
73.     EXLOOP RESOUT RESULTPRINTER GETUPLE
74.     |       |                   PRETTYASSR ASSRPRINT
75.     |       EXPLAIN QHTAKE QHFOLLOW QHCLEAR
76.     |       |       |           QHPREP QHPREP {76}
77.     |       |       |           |      QHMAKE QHPUT
78.     |       |       |           |             QHMAKE {77}
79.     |       |       |           |             QHGET
80.     |       |       |           QHMAKE {77}
81.     |       |       |           QHSHOW QHPREP {76}
82.     |       |       |           QHFOLLOW {75}
83.     |       |       |           QHASK BEEP
84.     |       |       |                 QHLIST QHLIST {84}
85.     |       |       |                 |      QHGET
86.     |       |       |                 QHGET
87.     |       |       RETRIEVES {54}
88.     |       |       NEWVALOBJ GETUPLE
89.     |       MSGMTR BEYONDINTEREST
90.     |               INTERPOLABLE
```

```
91.          |                FREEZE
92.          |                UNFREEZE apply
93.          |                OWNMSG CASSERT SAVEPULSAR PULSAR
94.          |                |      |       SERT ADDH PUTSH PUTSTREAM apply
95.          |                |      |       |     |          GETSH {55}
96.          |                |      |       |     ENDSTREAM
97.          |                |      |       |     MATCHER
98.          |                |      |       |     BUMP
99.          |                |      |       |     GETSH {55}
100.         |                |      |       GETSTRIP STRIPSTREAM
101.         |                |      |                GETH {55}
102.         |                |      DISPLAY {e}
103.         |                |      NEWSYM
104.         |                DESCRIBEMSG WAITER TEKWAIT
105.         |                |           DSPCMD FKCALL {9}
106.         |                |           |      GRATEK TEKCOM
107.         |                |           |      |      PRINCHAR
108.         |                |           |      MONTEK TEKCOM
109.         |                |           CENTROID
110.         |                WEATHERMSG CASSERT {93}
111.         |                |          DSPADDTRH {64}
112.         |                |          DSPADDINC {67}
113.         |                SENSORMSG CASSERT {93}
114.         |                |         DISPLAY {e}
115.         |                |         NEWSYM
116.         |                EWMSG CASSERT {93}
117.         |                      DISPLOB DISPLAY {e}
118.         |                      |       MIDP TWO-PLACE
119.         |                      NEWSYM
120.         |                      GETPOINT FIXLONG
121.         |                      OWNPOS PLATPOS RETRIEVER GETSTRIP {100}
122.         |                                     |         RETVARS VAR?
123.         |                                     |         GETUPLE
124.         |                                     |         VAR?
125.         |                                     GETATT {g}
126.         |                                     PREDICTPOS GETATT {g}
127.         |                                                ESTIMATE {h}
128.         |                                                ONEPOINT {i}
129.      APPLYRULE SWEEPER apply
130.         |              SWEEPER {129}
131.         |              ORHACK SWEEPER {129}
132.         |              NOTHACK ORACLEHACK VAR?
133.         |              |       |          apply
134.         |              |       |          CASSERT {93}
135.         |              |       |          GETMRVAL
```

```
36.     |                   |       MAPRETRIEVE MAPSTREAM apply
37.     |                   |       |           RETSTREAM VAR?
38.     |                   |       |           |         GETSH {55}
39.     |                   |       |           MAPRETDO SOMEPULSE apply
40.     |                   |       |                    GETPULSAR
41.     |                   |       |                    RETPULSEDO {j}
42.     |                   |       GETCON GETMB GETMARK
43.     |                   |       |      |     BMEAS MARKON
44.     |                   |       |      |           BLFN GETMD GETMARK
45.     |                   |       |      |           |    |     DMEAS {k}
46.     |                   |       |      |           |    GETCON {142}
47.     |                   |       |      |           |    GETMB {142}
48.     |                   |       |      |           DLFN GETMB {142}
49.     |                   |       |      |                GETCON {142}
50.     |                   |       |      |                GETMD {144}
51.     |                   |       |      GETMD {144}
52.     |                   |       |      GETCON {142}
53.     |                   |       SWEEPER {129}
54.     |                   UNLESSHACK ORACLEHACK {132}
55.     |                   |          CASSERT {93}
56.     |                   |          STRIPSTREAM
57.     |                   |          RETSTREAM {137}
58.     |                   |          MASSAGE1 VAR?
59.     |                   |          |        GETMRVAL
60.     |                   |          MAPRETRIEVE {136}
61.     |                   |          GETCON {142}
62.     |                   |          SWEEPER {129}
63.     |                   ANDHACK ORACLEHACK {132}
64.     |                   |       MAPRETRIEVE {136}
65.     |                   |       GETCON {142}
66.     |                   |       SWEEPER {129}
67.     |                   CONSTRUCT ORBUILD CONSTRUCT {167}
68.     |                   |         JUSTBUILD SAVEPULSAR {93}
69.     |                   |         |         SERT {94}
70.     |                   |         |         PULSE apply
71.     |                   |         |         MASSAGE1 {158}
72.     |                   |         |         GETSTRIP {100}
73.     |                   |         |         GETPULSAR
74.     |                   |         MASSAGE1 {158}
75.     |                   GETMRVAL
76.     PARTING FKKILL FKJSYS {3}
77.             |      FKHNDL
78.             |      FKPROG
79.             |      FKJFN
80.             |      FKDDT NOFORK {10}
```

```
181.              |       |     FKDDT_
182.              |       |     FKHNDL
183.              |       |     FKDDT {180}
184.              |       |     FKJSYS {3}
185.              |       |     FKSW {7}
186.              |       |     FKTTYSET {6}
187.              |      FKSHR
188.             DSPRELD FKJSYS {3}
-------------------------------------------------------------- overflow - a
189.FKSYMPUT FKHT_
-------------------------------------------------------------- overflow - b
190.DECSAMEDIGITS DECSAMEDIGITS {190}
-------------------------------------------------------------- overflow - c
191.LOCH PREHASH PREHASH {191}
192.     NEXTH
-------------------------------------------------------------- overflow - d
193.NEWHASH CREATH
194.        MAPH apply
195.        PUTH {56}
-------------------------------------------------------------- overflow - e
196.DISPLAY DISPCHECK
197.        DSPADDTRH {64}
198.        DISPMARK
199.        DSPADDINC {67}
200.        MELD
201.        IDENT RETRIEVER {121}
202.        |     GREATESTPROB GETCON {142}
203.        MEDIUM RETRIEVER {121}
204.               GREATESTPROB {202}
-------------------------------------------------------------- overflow - f
205.GETATTB GETUPLE
206.        STRIPSTREAM
207.        GETSH {55}
-------------------------------------------------------------- overflow - g
208.GETATT GETUPLE
209.       STRIPSTREAM
210.       GETSH {55}
-------------------------------------------------------------- overflow - h
211.ESTIMATE SPAN NEAREST DISTANCE SUBTEND
212.         GETATT {208}
213.         AUXINTERPOL FIXLONG
-------------------------------------------------------------- overflow - i
214.ONEPOINT GETATT {208}
215.         SPAN {211}
216.         CENTROID
```

```
217.          AUXINTERPOL {213}
------------------------------------------------------------------ overflow - j
218.RETPULSEDO apply
219.           GETUPLE
220.           PREPALIST VAR?
------------------------------------------------------------------ overflow - k
221.DMEAS MARKON
222.      BLFN {144}
223.      DLFN {148}
@end(verbatim)
```

```
ADDH[ARGS,NEWVAL]
  calls:      PUTSH
  called by: SERT

ADDIS[SN]
  calls:      DISPLAY,GETATTB,GETATT
  called by: INCLUDEPLAT
  binds:      PLT,POS,TIM

ANDHACK[CONDITIONS,ACTIONS,EV]
  calls:      ORACLEHACK,MAPRETRIEVE,LIST,FUNCTION,GREATERP,GETCON,SWEEPER,
              CONS
  called by: SWEEPER
  binds:      P,X,CLIST

APPLYRULE[RULENAME,PREBIND]
  calls:      SWEEPER,SUBLIS,GETPROP,CONS
  called by: STAMMER

ARRLOC[ARR]
  calls:      ARRAYP,FKARRAYP,IPLUS,LOC,ERROR

ASSERT[ARGLIST,NODENAME]
  calls:      SET,SAVEPULSAR,SERT,GETSTRIP,GENSYM,CONS
  binds:      REPLY,LEN,A
  uses free: ASSERTIONS

ASSRPRINT[PRINSPEC]
  calls:      STRINGP,NUMBERP,PRIN1,NTH,EVAL,TERPRI
  called by: PRETTYASSR
  uses free: BODY,OVERCONF,LSTFLG

AUXINTERPOL[PT1,PT2,DELTA]
  calls:      LIST,FPLUS,FTIMES,FDIFFERENCE,FIXLONG
  called by: ESTIMATE,ONEPOINT

BEARING[SITE]
  calls:      GETATT,OWNPOS,CENTROID,DIRECTION
  binds:      TIME,POS1,POS2

BEEP[]
  calls:      PRIN1,CHARACTER
  called by: QHASK

BEYONDINTEREST[TXT]
  called by: MSGMTR
```

```
BKDSPBUF[X]
  calls:      MAPC,CHCON,FKJSYS
  called by:  DSPINIT
  binds:      C
  uses free:  DSPTTYCODE

BLFN[BNODE]
  calls:      GREATERP,GETMD,GETCON,GETMB,MIN
  called by:  BMEAS,DMEAS
  binds:      BNCON
  uses free:  BMEASANS

BMEAS[BBOX]
  calls:      MINUSP,FGREATERP,RESETLST,GETPROP,RESETSAVE,MARKON,MAPC,BLFN,
              DLFN,FTIMES,FDIFFERENCE,FPLUS
  called by:  GETMB
  binds:      BMEASANS,RULECON,BASTLST,DMEASANS
  uses free:  BAST,MBCOMB

BUMP[L]
  calls:      DREVERSE,CONS
  called by:  SERT
  binds:      ANS

CASSERT[SPEC,VAL]
  calls:      GREATERP,PUTPROP,SET,SAVEPULSAR,SERT,GETSTRIP,GENSYM,CONS,ABS
  called by:  EWMSG,ORACLEHACK,OWNMSG,SENSORMSG,UNLESSHACK,WEATHERMSG,DENY,
              MAYBE,STATE
  binds:      NEWNODE
  uses free:  ASSERTIONS

CENTROID[VERTEXLIST]
  calls:      LIST,FQUOTIENT,ADD1,FPLUS
  called by:  BEARING,COURSE,COURSEFROM,CROSSPATHS,DESCRIBEMSG,GRAZE,IN-LANE,
              INSIDE,LOC-TIME,LOCATION,ONEPOINT,RANGE,SPEED,SPEEDFROM,SWR,
              WENT-AFTER,WENT-BEFORE
  binds:      I,C1,C2

CHANGECON[RLNME1]
  calls:      PRIN1,PUTPROP,CLEARBUF,GETPROP,READ,TERPRI

CKCONFIGURATION[]
  calls:      TEKTEST,EQP,DSPINIT,PRIN1,DSPMAP,CLEARBUF,STARTUP,HELP,CHCON1,
              ASKUSER,DSPGRAB,READ,DSPTTYSTR
  called by:  WELCOME
  uses free:  DUALFLG,DSPLAYFLG
```

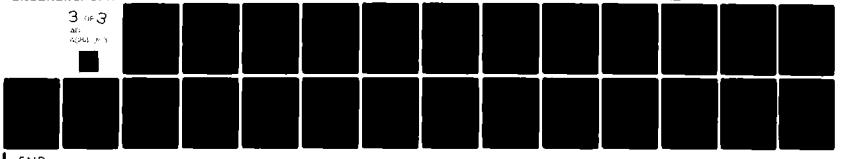
```
CONSTRUCT[ACTIONS,EV,COUNT]
  calls:      ORBUILD,JUSTBUILD,CONS,MASSAGE1
  called by:  ORBUILD,SWEEPER
  binds:      FIRST
  uses free:  RESULTLIST

COURSE[SITE]
  calls:      LESSP,GETATT,CENTROID,PREDECESSOR,SUCCESSOR,DIRECTION,
              FDIFFERENCE
  binds:      TIME,POS,PRED,SUC,TSUC,PSUC,TPRED,PPRED

COURSEFROM[POS1,POS2]
  calls:      CENTROID,DIRECTION

CREATH[SIZE]
  calls:      ARRAY,ADD1,IQUOTIENT,LOG,ITIMES
  called by:  NEWHASH
  uses free:  MEMFULLSIZE,MEMFILLED,MEMFACTOR,MEMSIZE,MEMORY

CROSSBOUNDARY[PT1,PT2,POLY]
  calls:      SOMELINESEG,FUNCTION,CROSSLINES
  called by:  LINPOLY
  binds:      PT3,PT4

CROSSLINES[A,B,P,Q]
  calls:      OPSIDES
  called by:  CROSSPATHS,CROSSBOUNDARY

CROSSPATHS[S1,S2,T1,T2]
  calls:      CENTROID,CROSSLINES
  binds:      P1,P2,Q1,Q2

CRUNCH[X]
  calls:      RPTQ,SETN,LOGOR,LLSH
  called by:  DSPCNVRT
  binds:      NUM,RPTN

DECSAMEDIGITS[X]
  calls:      LESSP,IPLUS,IREMAINDER,ITIMES,DECSAMEDIGITS,IQUOTIENT
  called by:  DECSAMEDIGITS,DSPTTYSTR

DEFINEPD[]
  calls:      PRIN1,MAKEPD,LINEREAD,APPEND
  binds:      PDNAME,NEWCON,CONDS,NEWACT,ACT,CONFID
```

```
DENY[L]
  calls:      CASSERT

DESCRIBEMSG[TXT]
  calls:      NUMBERP,TERPRI,SPACES,PRIN1,WAITER,DSPCMD,LAST,CENTROID,LIST
  called by:  MSGMTR
  binds:      POS,TIME,WKNM,SOURCE
  uses free:  OWNSHIP,CURTIME,DSPLAYFLG

DIRECTION[LAT1,LON1,LAT2,LON2]
  calls:      EQP,FGTP,LESSP,MINUSP,SETN,SUBTEND,FDIFFERENCE,FQUOTIENT,
              FTIMES,COS,SIN,ARCSIN,FPLUS
  called by:  BEARING,COURSE,COURSEFROM,INTERIOR,ROTSENSE,WENT-AFTER,
              WENT-BEFORE
  binds:      PSI,LONDIF,BEARSIN,BEARANGLE

DISPCHECK[NAME]
  calls:      GETPROP
  called by:  DISPLAY

DISPLAY[PLATNAME,LAT,LON,TIME]
  calls:      DISPCHECK,DSPADDTRH,DISPMARK,DSPADDINC,FLOAT,MELD,IDENT,MEDIUM
  called by:  ADDIS,DISPLOB,OWNMSG,SENSORMSG
  uses free:  DSPLAYFLG

DISPLOB[PNAME,SPOS,DPOS,TIME]
  calls:      DISPLAY,MIDP
  called by:  EWMSG
  binds:      TEMP1,TEMP2
  uses free:  DSPLAYFLG

DISPMARK[NAME]
  calls:      PUTPROP
  called by:  DISPLAY

DISSIMILPLAT[PLAT1,PLAT2]
  calls:      EQUAL,MAPC,GETATT
  called by:  POSS-REPORT
  binds:      VAL1,VAL2,SUCCESSFLG,CHAR
  uses free:  SHIPCHARS

DISTANCE[LAT1,LON1,LAT2,LON2]
  calls:      FTIMES,SUBTEND
  called by:  DISTOLINE,NEAREST,RANGE,SPEED,SPEEDFROM,SWR,WENT-AFTER,
              WENT-BEFORE
```

```
DISTOLINE[X,Y,X1,Y1,X2,Y2]
  calls:      MINUSP,SETN,DISTANCE,QUOTIENT,FDIFFERENCE,FPLUS,FTIMES,TIMES,
              MIN,SIN,ARCCOS
  called by: GRAZE,INLANE
  binds:      A,B,C,COS1,COS2

DLFN[DNODE]
  calls:      FGREATERP,GETMB,GETCON,GETMD,MAX
  called by: BMEAS,DMEAS
  binds:      DNCON
  uses free: DMEASANS

DMEAS[DBOX]
  calls:      MINUSP,FGREATERP,RESETLST,GETPROP,RESETSAVE,MARKON,MAPC,BLFN,
              DLFN,FTIMES,FDIFFERENCE,FPLUS
  called by: GETMD
  binds:      DMEASANS,RULECON,DASTLST,BMEASANS
  uses free: DAST,MDCOMB

DSPADDINC[NAME,LAT,LON,TIME]
  calls:      FKCALL,DSPCNVRT
  called by: DISPLAY,STUFFLN,WEATHERMSG

DSPADDINCS[NAME,INCLST]
  calls:      FKCALL,DSPCNVRT,MAPC
  binds:      INC

DSPADDTRH[NAME,ID,TYPE]
  calls:      FKCALL,DSPCNVRT
  called by: DISPLAY,STUFFLN,WEATHERMSG

DSPCHGTRH[NAME,ID,TYPE]
  calls:      DSPQUIET,DSPEXCH,FKSETVAL,FKCALL,DSPTTY

DSPCMD[CMD,WAITFLG]
  calls:      EQP,FKCALL,GRATEK,TERPRI,GETTOPVAL,MONTEK
  called by: DESCRIBEMSG,PRINTRULEASSR
  binds:      DSPNOWAITFLG
  uses free: DSPTTYCODE,TEK4025

DSPCNVRT[X]
  calls:      DCHCON,CRUNCH,NTH
  called by: DSPADDINC,DSPADDINCS,DSPADDTRH,DSPINIT
  uses free: SCRATCHTEN,DSPWORD1,DSPWORD2
```

AD-A084 053 SDC INTEGRATED SERVICES INC SAN DIEGO CA F/G 9/2
STAMMER2 PRODUCTION SYSTEM FOR TACTICAL SITUATION ASSESSMENT, V--ETC(U)
OCT 79 D C MCCALL, P H MORRIS, D F KIBLER N00123-76-C-0172
UNCLASSIFIED NOSC-TD-298-VOL-2 NL

3 OF 3
AD
A084 053



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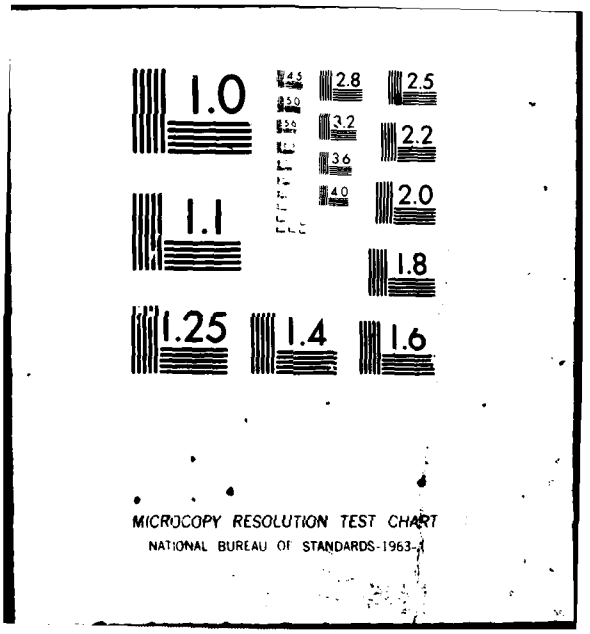
1.0
1.1
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2.0
2.2
2.5
2.8
3.2
3.6
4.0
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

```
DSPERASE[]
  calls:      FKCALL,TEKWAIT

DSPEXCH[NAME]
  calls:      FKCALL,RPTQ,RPLSTRING,ADD1,ITIMES,NTHCHAR
  called by:  DSPCHGTRH
  binds:      RPTN
  uses free:  DSPEXCHBUF

DSPEXP[BOX]
  calls:      MEMB,ZEROP,IGREATERP,MAPC,CONS,GETUPLE,ADD1,APPLY,DREVERSE,
              CONCAT
  called by:  PRINTRULEASSR
  binds:      X,DSPLST,COUNT,DSPOBJECTS,BLANK,COMMA
  uses free:  OWNSHIP

DSPGRAB[TTYNO]
  calls:      IPLUS,OCTSAMEDIGITS,FKJSYS
  called by:  CKCONFIGURATION
  uses free:  DSPTTYCODE

DSPINIT[]
  calls:      FKINIT,DSPQUIET,BKDSPBUF,DSPCNVRT,FKSETVAL,FKCALL,DSPTTY,
              DSPTTYSTR,TERPRI
  called by:  CKCONFIGURATION
  globals:    DSPNOWAITFLG

DSPMAP[]
  calls:      FKSETVAL,INFILEP,PRIN1,TERPRI
  called by:  CKCONFIGURATION

DSPNOMAP[]
  calls:      FKSETVAL

DSPNUMAT[X]
  calls:      MAPCAR,DSPNUMAT,PACKC,UNCRUNCH
  called by:  DSPNUMAT,FKVALAT

DSPQUIET[]
  calls:      FKCALL,FKJSYS,LOGOR,LLSH
  called by:  DSPCHGTRH,DSPINIT
  uses free:  DSPTTYCODE
  globals:    FORKDATA
```

```
DSPRELD[]
  calls:      FKJSYS
  called by:  DSPSAVE,PARTING
  uses free:  DSPTTYCODE

DSPSAVE[]
  calls:      FKCALL,DSPRELD,FKKILL,FKSAVE

DSPSTAT[]
  calls:      FKJSYS,LRSH
  uses free:  FKJSYSAC1
  globals:    FORKDATA

DSPTOP[WAITFLG]
  calls:      FKCALL,EQP,RESETLST,GETTOPVAL,RESETSAVE,GRATEK
  binds:      DSPNOWAITFLG,FIRSTCMD
  uses free:  DSPTTYCODE,TEK4025

DSPTTY[]
  calls:      FKCALL,FKJSYS,LOGOR,LLSH
  called by:  DSPINIT,DSPCHGTRH
  uses free:  DSPTTYCODE
  globals:    FORKDATA

DSPTTYSTR[]
  calls:      EQP,CONCAT,DECSAMEDIGITS,IDIFFERENCE
  called by:  CKCONFIGURATION,DSPINIT
  uses free:  DSPTTYCODE

ENDSTREAM[S]
  calls:      RPLACD
  called by:  SERT

ESTIMATE[SITE1,SITE2,GAP]
  calls:      PRIN1,TERPRI,MAPCAR,SPAN,GETATT,AUXINTERPOL
  called by:  PREDICTPOS
  binds:      X
  uses free:  EXPLAINFLAG

EWMSG[TXT,EXTFLG]
  calls:      CASSERT,DISPLOB,NEWSYM,LIST,GETPOINT,OWNPOS
  called by:  MSGMTR
  binds:      TIME,TEMPLACE1,TEMPLACE2,SNODE,SOURCE,BEAR,EMIT,WKNM
  uses free:  SENSORANGE
```

```
:XLOOP[]
  calls:      RESOUT,EXPLAIN,MSGMTR
  called by:  STAMMER
  binds:      MSGFLG

:XPLAIN[]
  calls:      QHTAKE,MAPC,CONS,RETRIEVES,NEWVALOBJ,ERSETQ
  called by:  EXLOOP
  binds:      DONEFLG,PLATFORM,MLANE,STORM,ID,ID-AMP,TYPE,VALUE,OBJECT
  uses free:  ASSERTIONS,RELATIONS,PRODUCTIONS,RELATION,RULENAME

'ANCYPROD[PRO]
  calls:      PRIN1,PRINT,TAB,GETPROP,PRETTYASSR,MAPC,TERPRI
  binds:      C,A,X,CART,CARTEL

'ASTHAK[]
  calls:      MAPH,FUNCTION,MEMTEST
  uses free:  MEMSIZE,MEMORY

'IXLONG[X]
  calls:      FLESSP,FDIFFERENCE,FPLUS
  called by:  AUXINTERPOL,GETPOINT

'KACS[]
  calls:      RPLACA,ARRAY
  called by:  FKCALL,FKSETVAL,FKVALI,SAILCALL
  binds:      Y,X
  globals:    FORKDATA

'KACSRETURN[ARRAY]
  calls:      RPLACA,CONS
  called by:  FKCALL,FKSETVAL,FKVALI,SAILCALL
  binds:      Y
  globals:    FORKDATA

'KARRADR[FKARRNAME,FKINDEX,FKNWORDS]
  calls:      GETD,NUMBERP,ERROR,FKBCHECK,MAPC,EVAL,FKARRAYP,LOC,MAPCAR,
              LOGAND,OPENR,SUB1,LRSH,EQP,LENGTH,IDIFFERENCE,IPLUS,ITIMES,
              ADD1
  called by:  FKELTI,FKELTR,FKSETA
  binds:      FKADR,FKDIMS,FKSIZE,FKOFFSET,FKNDIM,FKPTR,FKLOW,FKARRY,X
```

```
FKARRAY[FKA,FKTYPE,FKSIZE,FKSIZE2]
  calls:      GETD,NUMBERP,ILESSP,NOFORK,FKSYMPUT,MAPC,EVAL,MAPCAR,ERROR,
              ADD1,ITIMES,LIST,REVERSE,CONS,IPLUS,IDIFFERENCE,FKCORGET,LOGOR,
              FKHT,FKSHR,IMINUS,FKIDPB,LLSH,SET,VAG
  binds:      FKHI,FKOFFSET,FKNDIM,FKTOTALSIZE,FKDOPE,FKDIMS,FKLO,FKLOC,
              FKBYTP,FKDATAWD,FKSIZES,WORD
  globals:    FORKDATA

FKARRAYP[A]
  calls:      IGREATERP,FKSHR,LOC
  called by:  ARRLOC,FKCALL,SAILARG,FKARRADR
  binds:      SHR
  globals:    FORKDATA

FKARRAYSIZE[A]
  calls:      LOGAND,OPENR,SUB1,LOC

FKARRAYTYPE[A]
  calls:      ZEROP,LRSH,OPENR,SUB1,LOC,IDIFFERENCE,IPLUS,ITIMES
  called by:  FKCALL,FKELT
  binds:      NDIM

FKBCHECK[N,LO,HI]
  calls:      IGREATERP,ILESSP,ERROR
  called by:  FKARRADR

FKCALL[FKCX]
  calls:      LITATOM,FIXP,FLOATP,STRINGP,ARRAYP,IGREATERP,FKARRAYP,NOFORK,
              FKWAIT,FKIDPB,FKCALLERR,RPTQ,SETA,ERROR,PUTTYP,FKSACS,FKSW,
              FKACSRETURN,FKRACS,MAPC,FKHNDL,FKHT,FKACS,LOGOR,IPLUS,LOC,EVAL,
              FKSYM,FKCATYPE,SUB1,CONS,FKSR,ARRAYSIZE,IDIFFERENCE,ELT,
              FKARRAYTYPE,FKSHR,ADD1,SET,FKRTN
  called by:  DSPADDINC,DSPADDINCS,DSPADDTRH,DSPEXCH,DSPQUIET,DSPTOP,DSPTTY,
              DSPCHGTRH,DSPCMD,DSPERASE,DSPINIT,DSPSAVE
  binds:      FKHNDL,FKHT,FKCA,FKCBP,FKCABP,FKCID,FKCARG,FKBIAS,FKCTYPE,
              FKCRESLIST,FKCWRDS,FKCN,FKCARGS,FKRESULTYPE,FKRESULT,RPTN,X,
              FKCVAL
  globals:    FORKDATA,DSPNOWAITFLG

FKCALLERR[FKCID]
  calls:      ERROR
  called by:  FKCALL,SAILCALL

FKCATYPE[FKID]
  calls:      ILESSP,IGREATERP,CHCON1
  called by:  FKCALL,FKVAL
  binds:      C
```

```
FKCORGET[SIZE]
  calls:      IGREATERP,ERROR,RPLACA,FKSHR,FKPROG,IDIFFERENCE
  called by:  FKARRAY
  binds:      SHR,X
  globals:    FORKDATA

FKDDT[DDTFILE]
  calls:      ZEROP,EQP,NOFORK,ERROR,FKDDT_,RESETFORM,FKHNDL,FKDDT,LOGOR,
              LLSH,LOGAND,FKJSYS,MKSTRING,FKSW,FKTTYSET
  called by:  FKDDT,FKKILL
  binds:      FKHNDL,EV,DDT
  uses free:  FKJSYSAC1,FKJSYSAC2
  globals:    FORKDATA

FKELT[FKELT!A,FKELT!N,FKELT!WORDS]
  calls:      APPLY*,FKARRAYTYPE,EVAL,FUNCTION,FKELTR,FKELTI

FKELTI[FKELTI!A,FKELTI!N,FKELTI!WORDS]
  calls:      EVAL,FKARRADR,RPTQ,CONS,OPENR,IPLUS
  called by:  FKELT
  binds:      PTR,ANS,RPTN

FKELTR[FKELTR!A,FKELTR!N,FKELTR!WORDS]
  calls:      EVAL,FKARRADR,RPTQ,CONS,FKFLOAT,IPLUS
  called by:  FKELT
  binds:      PTR,ANS,RPTN

FKFLOAT[ADR]
  calls:      ASSEMBLE,VAG
  called by:  FKELTR,FKVALI

FKINIT[PROGRAM]
  calls:      MEMBER,ILESSP,IGREATERP,FKRACS,RPTQ,ARRAY,HARRAY,INFILEP,
              UNPACK,PACK,LIST,ERROR,FKJSYS,MKSTRING,LOGOR,LLSH,LRSH,
              RESETFORM,FKTTYSET,FKSW,ADD1,ELT,EQP,LOC,GETBLK,SUB1,IPLUS,
              IDIFFERENCE
  called by:  DSPINIT,NOFORK
  binds:      PROGFILE,FKJFN,FKHNDL,HALTED,EV,HALTADR,PGS,SOURCE,DEST,FKSHR,
              FKACS,LISPBLOCK,RPTN,SIZE,FKHT,FKSYMACS,FKDDT
  uses free:  FKJSYSAC2,FKJSYSAC1
  globals:    FORKDATA
```

```
FKJSYS[FKJSYSNO,ARG1,ARG2,ARG3,ARG4,ARG5]
  calls:      ASSEMBLE,VAG,FKJSYSARG,LOC,AC
  called by:  FKTIME,DSPQUIET,DSPSTAT,DSPTTY,FKKILL,FKSR,FKSW,FKTTYSET,
              FKWAIT,BKDSPBUF,DSPGRAB,DSPRELD,FKDDT,FKINIT,FKSAVE
  uses free:  FKJSYSAC3,FKJSYSAC2,FKJSYSAC1

FKJSYSARG[X]
  calls:      STRINGP,ZEROP,ARRAYP,NUMBERP,CHCON1,NTHCHAR,CONCAT,CHARACTER,
              IPLUS,LOC,LSH,LOGAND,LOGOR,IQUOTIENT,LLSH,IDIFFERENCE,ITIMES,
              IREMAINDER,ERROR,VAG
  called by:  FKJSYS
  binds:      ARG,S
  uses free:  FKJSYSTR

FKKILL[]
  calls:      EQP,FKJSYS,RELBLK,EVALV,FKHNDL,RSH,FKPROG,FKJFN,FKDDT,FKSHR,
              VAG,LRSH,IDIFFERENCE
  called by:  DSPSAVE,PARTING
  binds:      FKPROG,DDT,SHR
  uses free:  FKJSYSAC1
  globals:    FORKDATA

FKRTN[TYPE,A,N]
  calls:      ZEROP,ELT,ASSEMBLE,VAG,IPLUS,LOC,ERROR
  called by:  FKCALL,SAILCALL

FKSAVE[FILE]
  calls:      ERROR,FKJSYS,MKSTRING,LOGOR,LLSH,FKHNDL,INFILEP
  called by:  DSPSAVE
  binds:      JFN
  uses free:  FKJSYSAC1
  globals:    FORKDATA

FKSETA[FKARRY,FKINDEX,FKEXPR]
  calls:      EVAL,FKARRADR,LENGTH,MAPCAR,CLOSER,ADD1
  binds:      FKVAL,FKPTR,FKV

FKSETVAL[FKADR,FKBIAS,FKVAL]
  calls:      IGREATERP,NUMBERP,NOFORK,FKWAIT,HELP,RPLACD,MAPC,FKSACS,FKSW,
              FKACSRETURN,FKHNDL,FKHT,FKACS,LOGOR,IPLUS,LOC,FKSYM,EVAL,LIST,
              LENGTH,COPY,NTH,FKIDPB,ERROR
  called by:  DSPMAP,DSPNOMAP,DSPCHGTRH,DSPINIT
  binds:      VAL,FKHNDL,FKHT,FKACS,FKBP,FKRESULT
  globals:    FORKDATA
```

```
FKSR[A,I,STR]
  calls:      IGREATERP,RPTQ,SETA,FKJSYS,LOGOR,IPLUS,LOC,NCHARS,IDIFFERENCE,
              ARRAYSIZE,SUB1,ADD1,IQUOTIENT,IMINUS
  called by:  FKCALL
  binds:      WDS,SIZE,ROOM,RPTN,DESTPTR

FKSW[FKHNDL,I,FKNOWAITFLG]
  calls:      ILESSP,EQP,FKJSYS,RESETFORM,FKHALT,LOGAND,RADIX,HELP
  called by:  FKCALL,FKSETVAL,FKSYM,FKVALI,SAILCALL,FKDDT,FKINIT
  binds:      EXPECTED,HALTED
  uses free:  FKJSYSAC2
  globals:    FORKDATA,DSPNOWAITFLG

FKSYM[ID,FKHT,NOBREAK]
  calls:      ZEROP,SETA,FKSACS,FKSW,FKRACS,ERROR,FKHT,NOFORK,FIXP,GETHASH,
              FKSYMACS,FKHNDL,GETRADIX50,ELT,FKSYMPUT
  called by:  FKCALL,FKSETVAL,FKSYMP,FKVALI,SAILARG,SAILCALL
  binds:      P,FKHNDL
  globals:    FORKDATA

FKSYMP[ID]
  calls:      FKSYM

FKSYMPUT[FKHT,ID,V]
  calls:      PUTHASH,FKHT_,LIST
  called by:  FKARRAY,FKSYM
  binds:      HTL
  globals:    FORKDATA

FKTIME[FKEXPR]
  calls:      FKJSYS,FKHNDL,EVAL,FQUOTIENT,IDIFFERENCE,LIST,FPLUS
  binds:      FKHNDL,FKFORKTIME,FKLISPTIME,FKRESULT
  uses free:  FKJSYSAC2,FKJSYSAC1
  globals:    FORKDATA

FKTTYSET[BOOL]
  calls:      FKJSYS
  called by:  FKDDT,FKINIT
  uses free:  FKJSYSAC3,FKJSYSAC2,FKTTYSETCALLED,FKTIW,FKFMOD,FKCC2,FKCC1

FKVAL[FKADR,FKBIAS,FKWORDS]
  calls:      APPLY*,FKCATYPE,FKVALI

FKVALAT[ID,BIAS,NVALS]
  calls:      DSPNUMAT,APPLY,LIST,FKVALI
```

```
FKVALI[FKADR,FKBIAS,FKWORDS,FKREAL]
  calls:      IGREATERP,NOFORK,FKWAIT,FKIDPB,FKSACS,FKSW,FKRACS,HELP,RPTQ,
              FKACSRETURN,FKHNDL,FKHT,FKACS,LOGOR,IPLUS,LOC,FKSYM,EVAL,CONS,
              FKFLOAT,OPENR
  called by:  FKVAL,FKVALAT,FKVALR
  binds:      FKHNDL,FKHT,FKACS,FKBP,FKRESULT,RPTN
  globals:    FORKDATA

FKVALR[FKADR,FKBIAS,FKWORDS]
  calls:      APPLY*,FKVALI

FKWAIT[FKHNDL]
  calls:      MEMB,FKJSYS,DISMISS,HELP,LRSH,LOGAND
  called by:  FKCALL,FKSETVAL,FKVALI
  uses free:  FKJSYSAC2,FKJSYSAC1,FKSTATUS

FKX[FKCX]
  calls:      EVAL,LIST

FREEZE[]
  called by:  MSGMTR
  uses free:  FREEZEFLG

GAMF[WLK,OVERRIDE]
  calls:      FGREATERP,FLESSP,PRIN1,GETCON,ABS,EQP
  called by:  MODIFIER,NICEANSWER,YESNO
  binds:      CONFI,ACON

GETATT[REL,NAME]
  calls:      RPLACA,GETUPLE,STRIPSTREAM,GETSH
  called by:  ADDIS,BEARING,COURSE,DISSIMILPLAT,ESTIMATE,LOC-TIME,LOCATION,
              ONEPOINT,PLATPOS,PREDECESSOR,PREDICTPOS,RANGE,SPEED,STUFFLN,
              SUCCESSOR
  binds:      SPEC

GETATTB[REL,NODE]
  calls:      RPLACA,GETUPLE,STRIPSTREAM,GETSH
  called by:  ADDIS,POSS-REPORT,PREDECESSOR,SUCCESSOR
  binds:      SPEC

GETCON[SOMAST]
  calls:      ATOM,FDIFFERENCE,GETMB,GETMD,MAPCAR,GETCON
  called by:  BLFN,DLFN,GAMF,GETCON,GREATESTPROB,IMPLIESASRT,MODIFIER,
              PRINTRULEASSR,YESNO,ANDHACK,NOTHACK,UNLESSHACK
```

```
GETH[ARGS]
  calls:      ELTD,LOCH
  called by:  GETSH,GETSTRIP
  uses free:  MEMORY

GETMARK[NODE]
  calls:      GETPROP
  called by:  GETMB,GETMD

GETMB[BAST]
  calls:      MAPC,GETPROP,GETMARK,BMEAS
  called by:  BLFN,DLFN,GETCON
  binds:      HNDL,MBCOMB

GETMD[DAST]
  calls:      MAPC,GETPROP,GETMARK,DMEAS
  called by:  BLFN,DLFN,GETCON
  binds:      DNDL,MDCOMB

GETMRVAL[X,COPYFLG]
  calls:      SUBLIS
  called by:  MASSAGE1,ORACLEHACK,SWEEPER
  uses free:  MAPRETALIST

GETPOINT[POS,BEAR,RANGE]
  calls:      EQUAL,FGTP,FQUOTIENT,SIN,COS,ARCSIN,FPLUS,FTIMES,ABS,LIST,
              ARCCOS,MAX,MIN,FDIFFERENCE,FMINUS,FIXLONG
  called by:  EWMSG
  binds:      SINLAT,COSPSI,COSLAT,SINPSI,COSBEAR,NEWLAT,COSNEWLAT,TMP,TMP2,
              NEWLONG,LAT,PSI,LONG

GETPULSAR[NODE]
  calls:      GETPROP
  called by:  JUSTBUILD,MAPRETDO

GETRADIX50[S]
  calls:      ILESSP,IGREATERP,RPTQ,NCHARS,SUBSTRING,CHCON1,GNC,IDIFFERENCE,
              IPLUS,ITIMES
  called by:  FKSYM
  binds:      RADTMP,RAD,LEN,TS,RPTN

GETSH[ARGS]
  calls:      GETH,PUTH,APPEND,NEWSTREAM
  called by:  GETATT,GETATTB,PUTSH,RETRIEVES,RETSTREAM,SERT
```

```
GETSTRIP[ARGS]
  calls:      STRIPSTREAM,GETH
  called by:  ASSERT,CASSERT,JUSTBUILD,RETRIEVER,YESNO

GETUPLE[ASSER]
  calls:      EVAL
  called by:  DSPEXP,GETATT,GETATTB,IMPLIESASRT,NEWVALOBJ,RESULTPRINTER,
              RETPULSEDO,RETRIEVER,RETRIEVES

GRATEK[]
  calls:      TEKCOM,PRINCHAR,PRIN1,JSYS,TERPRI,DOBE
  called by:  DSPCMD,DSPTOP

GRAZE[S1,S2,T1,T2]
  calls:      CENTROID,LESSP,DISTOLINE
  binds:      POS1,POS3,POS4,POS2
  uses free:  PATROLRANGE

GREATER-THAN[Q1,Q2]
  calls:      GREATERP

GREATESTPROB[POSLIST]
  calls:      GREATERP,EQP,MAPC,GETCON
  called by:  IDENT,MEDIUM
  binds:      ANSCON,ANS,A

HLPEXPLN[]
  calls:      PRIN1,TERPRI

IDENT[NAME]
  calls:      RETRIEVER,LIST,GREATESTPROB
  called by:  DISPLAY
  binds:      POSIB,ANS

IMPLIESASRT[NODE]
  calls:      EQP,TERPRI,PRIN1,MAPC,GETPROP,GETCON,GETUPLE,MEMBER,APPEND,
              LIST,SPACES
  binds:      X,Y
  uses free:  RULE

IN-LANE[MLANE,POS]
  calls:      CENTROID,LAST,FGREATERP,LANERANGE
  binds:      X,Y
```

```
INCLUDEPLAT[PNE]
  calls:      MAPC,RETRIEVES,ADDIS
  called by:  STARTUP

INLANE[X,Y,LANE]
  calls:      SOME,SETN,LESSP,DISTOLINE
  binds:      X1,Y1,X2,Y2,LANEPOINT
  uses free:  MERCHANTLANEWIDTH

INSIDE[POS,STORM]
  calls:      APPLY,APPEND,CENTROID,CONS,INTERIOR

INTERIOR[OLAT,OLON,POLYGON]
  calls:      LESSP,SETN,MAPC,LAST,DIFFERENCE,DIRECTION,PLUS,GREATERP,ABS
  called by:  LINPOLY,INSIDE
  binds:      SUM,INC,POS1,POS,LAT,LON,LAT1,LON1

INTERPOLABLE[TXT]
  called by:  MSGMTR

JUGGLE[PAIR,INSERTITEM]
  calls:      LIST

JUSTBUILD[SPEC,EV,NUMBER]
  calls:      PUTPROP,SET,SAVEPULSAR,SERT,PULSE,MASSAGE1,GETSTRIP,GENSYM,
              CONS,REVERSE,GETPROP,GETPULSAR
  called by:  CONSTRUCT
  binds:      MASSAGESPEC,NEWNODE,NEWFLG
  uses free:  ASSERTIONS,RESULTLIST

LANERANGE[ALAT,ALON,BLAT,BLON,CLAT,CLON]
  calls:      SETN,COS,SIN,FTIMES,ABS,FDIFFERENCE,ARCCOS,FQUOTIENT,FPLUS,
              SUBTEND
  called by:  IN-LANE
  binds:      A1,B1,C1,A2,B2,C2,A3,B3,C3,CAT,CAN,CBT,CBN,CCT,CCN,SAN,SBN,SCN,
              SAT,SBT,SCT

LESS-THAN[Q1,Q2]
  calls:      GREATERP

LINEREAD[]
  calls:      BKLINBUF,READP,READLINE
  called by:  DEFINEPD,WELCOME

LINPOLY[PT1,PT2,POLY]
  calls:      CROSSBOUNDARY,INTERIOR
  called by:  TRACKINPOLY
```

```
LOC-TIME[S]
  calls:      NCONC1,CENTROID,GETATT

LOCATION[S]
  calls:      CENTROID,GETATT

LOCH[ARGS,PUTFLG]
  calls:      EQUAL,PREHASH,ELT,NEXTH,ADD1
  called by:  GETH,PUTH
  binds:      LOC,CONT
  uses free:  MEMORY,MEMTESTCNT

M[L]
  calls:      NCONC,MAKEFILE
  uses free:  DSPLAFNS

MAKEPD[NAM,CO,AC,TRUST]
  calls:      PUTPROP,CONS
  called by:  DEFINEPD
  uses free:  PRODUCTIONS

MAKEPRINT[RELN]
  calls:      TERPRI,MAPC,SPACES,PUTPROP,GETPROP,PRIN1,READ,APPEND,CONS
  binds:      PFORM,NEWFORM,X

MAPH[ARY,ARYSZ,ARYFN]
  calls:      GREATERP,APPLY*,ELT,ELTD,ADD1
  called by:  NEWHASH,FASTHAK
  binds:      COUNT,CONTENT

MAPRETDO[SELT,AI]
  calls:      SOMEPULSE,GETPULSAR,CONS,FUNCTION,RETPULSEDO
  called by:  MAPRETRIEVE

MAPRETRIEVE[MAPRETX,MAPRETINFO,MAPRETFN]
  calls:      MAPSTREAM,RETSTREAM,CONS,FUNCTION,MAPRETDO
  called by:  ANDHACK,NOTHACK,UNLESSHACK
  uses free:  MAPRETALIST

MAPSTREAM[MAPSTREAMX,MAPSTREAMINFO,MAPSTREAMFN]
  calls:      MAPC,TCONC,APPLY*,CONS
  called by:  MAPRETRIEVE
  binds:      X
```

```
MARKOFF[NODE]
  calls:      REMPROP

MARKON[NODE,MARK]
  calls:      PUTPROP
  called by:  BMEAS,DMEAS

MASSAGE1[SPECLIST]
  calls:      VAR?,MAPCAR,GETMRVAL
  called by:  CONSTRUCT,JUSTBUILD,UNLESSHACK
  binds:      X

MATCHER[L1,L2]
  calls:      DREVERSE,CONS
  called by:  SERT
  binds:      ANS

MAYBE[L]
  calls:      CASSERT

MEDIUM[NAME]
  calls:      RETRIEVER,LIST,GREATESTPROB
  called by:  DISPLAY
  binds:      TEMP1,RETURNER

MELD[ID,MED]
  calls:      PACK,LIST
  called by:  DISPLAY
  binds:      A,B

MEMDENSITY[]
  calls:      PRIN1,FTIMES,FQUOTIENT,TERPRI
  uses free:  MEMSIZE,MEMFILLED

MEMSAVE[FEE]
  calls:      SET,MAKEFILE,TERPRI,PRIN1,FILECOMS,CLEARBUF
  uses free:  MEMORYCOMS

MEMTEST[X,Y]
  calls:      PRIN1,LENGTH,TERPRI
  called by:  FASTHAK
  uses free:  COUNT

MIDP[P1,P2]
  calls:      GREATERP,FDIFFERENCE,ABS,MINUS,TWO-PLACE,FQUOTIENT,FPLUS
  called by:  DISPLOB
  binds:      TEMP2
```

```
MODIFIER[]
  calls:      MEMBER,GAMF,PRIN1,GETCON,TWO-PLACE
  binds:      CON
  uses free:  NODE,OVERCONF

MONTEK[]
  calls:      TEKCOM
  called by:  DSPCMD

MSGMTR[]
  calls:      BEYONDINTEREST,INTERPOLABLE,NUMBERP,INFILE,FREEZE,CLOSEF?,
              UNFREEZE,OWNMSG,DESCRIBEMSG,PRIN1,TERPRI,WEATHERMSG,SENSORMSG,
              EWMSG,INPUT,READ
  called by:  EXLOOP
  binds:      OLDIN,MSG
  uses free:  OWNSHIP,MSGFILE

NEAREST[PT,LST]
  calls:      FLESSP,MAPC,DISTANCE
  called by:  SPAN
  binds:      TEMP,Y,ANS,X

NEWHASH[]
  calls:      CREATH,MAPH,PLUS,IQUOTIENT,FUNCTION,PUTH
  called by:  PUTH
  binds:      LEFT,A,OLDSIZE,RIGHT
  uses free:  MEMSIZE,MEMORY

NEWSTREAM[]
  calls:      CONS
  called by:  GETSH

NEWSYM[NAME]
  calls:      PUTPROP,ADD1,GETPROP,CONS,PACK,APPEND,UNPACK
  called by:  EWMSG,OWNMSG,SENSORMSG
  uses free:  SYMBOLS

NEWVALOBJ[ARRT]
  calls:      LESSP,LENGTH,GETUPLE,NUMBERP,MEMB,CONS
  called by:  EXPLAIN
  binds:      TUPLE,VL,OJ
  uses free:  OBJECT,VALUE
```

```
NEXTH[LOC,ARG]
  calls:      GREATERP,IDIFFERENCE,IPLUS
  called by:  LOCH
  binds:      NEWLOC
  uses free:  MEMSIZE

NICEANSWER[ANS1]
  calls:      GAMF,PRIN1,TERPRI
  called by:  PRETTYANS

NOFORK[]
  calls:      PRIN1,APPLY*,READ,FKINIT
  called by:  FKARRAY,FKCALL,FKDDT,FKSETVAL,FKVALI,FKSYM,SAILCALL
  globals:    FORKDATA

NOTHACK[CONDITIONS,ACTIONS,EV]
  calls:      ORACLEHACK,MAPRETRIEVE,FUNCTION,LESSP,GETCON,SWEEPER,CONS,LIST
  called by:  SWEEPER
  binds:      P,X,CLIST

OCCURPRINT[TIMES,NODE]
  calls:      ZEROP,EQUAL,PRINTRULEASSR,QHTAKE,GETPROP,SUB1
  binds:      X,Y,Z
  uses free:  RULE

OCTSAMEDIGITS[X]
  calls:      LESSP,IPLUS,IREMAINDER,ITIMES,OCTSAMEDIGITS,IQUOTIENT
  called by:  DSPGRAB,OCTSAMEDIGITS

ONEPOINT[NODE,GAP]
  calls:      PRIN1,TERPRI,FTIMES,GETATT,LIST,FDIFFERENCE,FPLUS,MAPCAR,SPAN,
              CENTROID,AUXINTERPOL
  called by:  PREDICTPOS
  binds:      LAT,LONG,X,POS,Y
  uses free:  EXPLAINFLAG

OPSIDES[A,B,P,Q]
  calls:      ROTSENSE
  called by:  CROSSLINES

ORACLEHACK[SPEC]
  calls:      VAR?,EQUAL,RPLACD,NCONC,CASSERT,GETMRVAL,GETPROP,LAST,NLEFT,
              APPLY,RPLACA
  called by:  ANDHACK,NOTHACK,UNLESSHACK
  binds:      ORTYPE,LASTCONS,PTR,LAST-ARG,ANS
```

```
ORBUILD[SPEC,EV]
  calls:      CONSTRUCT,LENGTH
  called by:  CONSTRUCT
  binds:      COUNT

ORHACK[CONDITIONS,ACTIONS,EV]
  calls:      MAPC,SWEEPER,CONS
  called by:  SWEEPER
  binds:      TEMP2

OWNMSG[TXT]
  calls:      CASSERT,DISPLAY,NEWSYM,LIST
  called by:  MSGMTR
  binds:      SNODE
  uses free:  OWNSHIP

OWNPOS[TIME]
  calls:      PLATPOS
  called by:  BEARING,EWMSG,RANGE
  uses free:  OWNSHIP

PARTING[]
  calls:      PRIN1,TERPRI,FKKILL,DSPRELD
  called by:  STAMMER
  uses free:  DSPLAYFLG

PLATPOS[PLAT,TIME]
  calls:      PRIN1,TERPRI,MAPCAR,RETRIEVER,LIST,CDADR,SUBSET,EQUAL,GETATT,
              PREDICTPOS
  called by:  OWNPOS
  binds:      X,Y,Z
  uses free:  EXPLAINFLAG

POSS-REPORT[S1,S2,PATROL]
  calls:      DISSIMILPLAT,MAPC,GETATTB
  binds:      PLAT1,SUCCESSFLG,SNG,PLAT2

PQ[L]
  calls:      SHOWPRINT,GETPROP
  binds:      SYSPRETTYFLG

PREDECESSOR[SITE]
  calls:      LESSP,MAPC,GETATTB,GETATT,RETRIEVES
  called by:  COURSE,SPEED
  binds:      PLAT,TOSSITE,TOSX,PRED,TOSPRED,X
```

```
PREDICTPOS[NODELIST,TIME]
  calls:      FLESSP,MAPC,GETATT,ESTIMATE,FQUOTIENT,FDIFFERENCE,ONEPOINT
  called by:  PLATPOS
  binds:      XT,LB2,LBT2,LB,LBT,UB2,UB,UBT,X
  uses free:  UBT2

PREHASH[L]
  calls:      LITATOM,NUMBERP,STRINGP,ZEROP,SETN,ADD1,IREMAINDER,IPLUS,LSH,
              LOGAND,LOC,VAG,MKATOM,PREHASH,HELP,SUB1
  called by:  LOCH,PREHASH
  binds:      N,C
  uses free:  MEMSIZE,PREHASHSUM1,PREHASHSUM

PREPALIST[CON,ASS,ALIST]
  calls:      VAR?,ASSOC,CONS
  called by:  RETPULSEDO
  binds:      C,A

PRETTYANS[ANSLST]
  calls:      PRIN1,TERPRI,MAPC,NICEANSWER

PRETTYASSR[NODE,FORMAT,OVERCONF]
  calls:      GREATERP,PRIN1,FRPLACD,MAPC,MEMB,CONS,EVAL,GETPROP,LENGTH,LIST,
              PLUS,NTH,ASSRPRINT
  called by:  FANCYPROD,PRINTRULEASSR,RECAPCONCS,RESULTPRINTER
  binds:      LSTFLG,BODY,FORMLST,USEFORM,I,$$END
  uses free:  ASSERTION

PRINCHAR[CODE]
  calls:      RESETFORM,ECHOCONTROL,PRIN1,CHARACTER
  called by:  GRATEK,TEKTEST
  binds:      X

PRINTRULEASSR[RULEASSRTS]
  calls:      ATOM,FLESSP,PRIN1,MAPC,TAB,PRETTASSR,WAITER,GETCON,PRETTYASSR,
              TERPRI,DSPCMD,DSPEXP
  called by:  OCCURPRINT,RULEXP
  binds:      Y
  uses free:  DSPLAYFLG

PULSAR[]
  calls:      CONS
  called by:  SAVEPULSAR
```

```
PULSE[PULSAR]
  calls:      APPLY*,RPLACA,CONSTANT,CONS,RPLACD
  called by:  JUSTBUILD
  binds:      CELL,PTR

PUTH[ARGS,AVAL]
  calls:      IGREATERP,NEWHASH,SETA,SETD,ADD1,LOCH
  called by:  GETSH,NEWHASH
  binds:      LOC
  uses free:  MEMORY,MEMFULLSIZE,MEMFILLED

PUTSH[ARGS,AVAL]
  calls:      PUTSTREAM,GETSH
  called by:  ADDH

PUTSTREAM[S,X]
  calls:      HELP,TCONC,MAPC,CONS,APPLY*
  called by:  PUTSH
  binds:      SUSP
  uses free:  FREEZELST,FREEZEFLG

QHASK[INBUF]
  calls:      MEMB,NUMBERP,TERPRI,TCONC,BEEP,QHLIST,MAPRINT,MAPC,RESETLST,
              RESETSAVE,CONTROL,ECHOMODE,RAISE,ECHOCONTROL,QHGET,PEEKC,CONS,
              PRIN1,READC,CHCON1,GETSYNTAX,CHARACTER,MKATOM,CONCAT,SUBSTRING,
              RESETFORM,READ
  called by:  QHFOLLOW
  binds:      PTR,BUFPTR,CHAR,CODE,NEWPTR,ITEM,NUM,X

QHCLEAR[]
  calls:      CLRHASH
  called by:  QHFOLLOW
  uses free:  QUERYHASHPTR

QHFOLLOW[LL,BUFPTR,QHMATCH]
  calls:      STRINGP,TCONC,QHCLEAR,QHPREP,QHMAKE,TERPRI,QHSHOW,MAPRINT,
              CLEARBUF,QHFOLLOW,EVALA,CONS,PRIN1,NTHCHAR,CONCAT,CHARACTER,
              SUBSTRING,QHASK,READ,EVALV,EVAL,REVERSE
  called by:  QHFOLLOW,QHTAKE
  binds:      L,X,ALIST,QHVAL
  uses free:  QHVAR

QHLIST[PTR]
  calls:      PRIN1,TERPRI,PRINT,RPTQ,QHLIST,QHGET,NTHCHAR,SUBSTRING,
              IDIFFERENCE
  called by:  QHASK,QHLIST
  binds:      ITEM,RPTN
```

```
QHMAKE[QHMAKEX,QHMAKEY,SHOWFLG]
  calls:      MEMB,MAPC,PRIN1,TERPRI,PRINT,RPTQ,QHPUT,QHMAKE,NTHCHAR,
              SUBSTRING,EVAL,MKATOM,NCHARS,CHCON1,IMINUS,QHGET,ADD1
  called by: QHFOLLOW,QHMAKE,QHPREP
  binds:      CHARCODE,NEWPTR,PTR,X,RPTN
  uses free: QUERYHASHPTR

QHPREP[FOCUS,QHLST,SHOWFLG,STK]
  calls:      QHPREP,MAPC,NTHCHAR,GETPROP,HELP,CONS,QHMAKE
  called by: QHFOLLOW,QHPREP,QHSHOW
  binds:      F,X

QHSHOW[L]
  calls:      QHPREP
  called by: QHFOLLOW

QHTAKE[L]
  calls:      QHFOLLOW,CONS
  called by: EXPLAIN,OCCURPRINT,RULEXP

RANGE[SITE]
  calls:      GETATT,OWNPOS,CENTROID,DISTANCE
  binds:      TIME,POS1,POS2

RECAPCONCS[]
  calls:      TERPRI,MAPC,PRETTYASSR
  uses free: ASSERTION

RESOUT[]
  calls:      MAPC,INTERSECTION,RESULTPRINTER
  called by: EXLOOP
  uses free: RESULTLIST

RESULTPRINTER[RES1]
  calls:      MEMB,MAPC,PRIN1,TERPRI,GETUPLE,PRETTYASSR
  called by: RESOUT
  uses free: DULLREL

RETPULSEDO[SELTAI]
  calls:      DECLARE,GETUPLE,PREPALIST,APPLY*
  called by: MAPRETDO
  binds:      ASS,MAPRETALIST,MAPRETINFO,MAPRETX,MAPRETFN,SELT,AI
```

```
RETRIEVER[SPEC]
  calls:      MAPC,MAP2C,GETSTRIP,RETVARS,GETUPLE,VAR?,CONS
  called by:  IDENT,MEDIUM,PLATPOS,WHAT2FORMFN,WHATFORMFN,WHOSE2FORMFN
  binds:      RES1,RES,W,A,B

RETRIEVES[AT,OBJ,VAL,SEL]
  calls:      ILESSP,MEMBER,RPLACA,RPLACD,MAPC,NCONC,LAST,STRIPSTREAM,GETSH,
              ADD1,MAPCAR,NTH,GETUPLE,CONS
  called by:  EXPLAIN,INCLUDEPLAT,PREDECESSOR,STARTUP,SUCCESSOR
  binds:      SPEC,LAST,ASSES,X,ANS,ELT,ASS,ONEFLG

RETSTREAM[C]
  calls:      VAR?,MAPC,RPLACA,RPLACD,ASSOC,GETSH
  called by:  MAPRETRIEVE,UNLESSHACK
  binds:      PTR,XASSOC,FOLLOW,S,SCRATCH,X
  uses free:  MAPRETALIST

RETVARS[SPEC]
  calls:      VAR?,MAPCAR
  called by:  RETRIEVER
  binds:      ITEM

ROTSENSE[A,B,C]
  calls:      LESSP,GREATERP,MINUSP,DIFFERENCE,DIRECTION
  called by:  OPSIDES
  binds:      ANGLE

ROUGHLY-THE-SAME-COURSE-AS[Q1,Q2]
  calls:      PLUS,GREATERP,DIFFERENCE

ROUGHLY-THE-SAME-SPEED-AS[Q1,Q2]
  calls:      PLUS,TIMES,GREATERP,DIFFERENCE

RULEXP[RULE,NODE]
  calls:      ZEROP,EQUAL,PRIN1,TERPRI,PRINTRULEASSR,QHTAKE,GETPROP,SUB1
  binds:      X,COUNT,Y,Z

SAILARG[FKARG,FKHT]
  calls:      ATOM,FMEMB,LITATOM,STRINGP,FKARRAYP,FIXP,FLOATP,MAP,LAST,LIST,
              EVAL,FKSYM,SAILSTRING,IPLUS,LOC,FKSHR,ERROR,LLSH,FIX,FLOAT,
              LOGOR
  called by:  SAILCALL
  binds:      FKVARBL,FKVALUE,VARTYPE,FKTYPE,FKCALLTYPE,FKRV,FKARRY,
              FKRESULTS,X
  globals:    FORKDATA
```

```
SAILARRAYSIZE[A]
  calls:      RPTQ,LOC,LRSH,OPENR,SUB1,IDIFFERENCE,CONS,REVERSE
  binds:      NDIM,X,ANS,RPTN

SAILCALL[FKCX]
  calls:      ATOM,IGREATERP,ERROR,SETA,FKCALLERR,FKIDPB,MAPC,PUTTYP,FKSACS,
              FKSW,FKACSRETURN,FKRACS,FKHNDL,NOFORK,FKHT,FKACS,LOGOR,IPLUS,
              LOC,FMEMB,FKSYM,SAILARG,CONS,ADD1,LENGTH,SET,FKRTN
  binds:      FKHNDL,FKHT,FKCA,FKCBP,FKCABP,FKRESULTBITS,FKCARG,FKTYPE,
              FKCRESLIST,FKCN,FKCARGS,FKRESULT,FKRESULTYPE,FKCID,WORD,X
  uses free:  FKTTYSETCALLED
  globals:    FORKDATA

SAILSTRING[STRING]
  calls:      RPTQ,CHCON,CONS,REVERSE,IPLUS,LLSH
  called by:  SAILARG
  binds:      CHLIST,PACKEDLIST,VAL,ZEROS,RPTN

SAME-AS[W,U]

SAVEPULSAR[NODE]
  calls:      PUTPROP,PULSAR
  called by:  ASSERT,CASSERT,JUSTBUILD

SENSORMSG[TXT]
  calls:      EQUAL,CASSERT,DISPLAY,NEWSYM,LAST,LIST
  called by:  MSGMTR
  binds:      SNODE,LAT,LON,SOURCE,TIME,STR,WKNM

SERT[SPEC,NODENAME]
  calls:      MEMB,RPTQ,ADDH,ENDSTREAM,SUB1,LENGTH,CONS,MATCHER,BUMP,GETSH
  called by:  ASSERT,CASSERT,JUSTBUILD
  binds:      LEN,A,RPTN

SOMELINESEG[SOMELINESEGX,SOMELINESEGFN]
  calls:      SOME,APPLY*
  called by:  CROSSBOUNDARY,TRACKINPOLY
  binds:      SOMELINESEGPT1,SOMELINESEGPT2

SOMEPULSE[PULSAR,PULSARDATA,SOMEPULSEFN]
  calls:      APPLY*,TCONC,CONS
  called by:  MAPRETDO
```

```
SPAN[L1,L2]
  calls:      IGREATERP,LENGTH,MAPCAR,LIST,NEAREST
  called by:  ESTIMATE,ONEPOINT
  binds:      X

SPEED[SITE]
  calls:      LESSP,GETATT,CENTROID,PREDECESSOR,SUCCESSOR,SPEEDM,DISTANCE,
              FDIFFERENCE
  binds:      TIME,POS,PRED,SUC,TSUC,PSUC,TPRED,PPRED

SPEEDAUX[T1,T2,DIST]
  calls:      FQUOTIENT,FDIFFERENCE
  called by:  SPEEDM

SPEEDFROM[POS1,T1,POS2,T2]
  calls:      CENTROID,SPEEDM,DISTANCE

SPEEDM[T1,T2,DIST]
  calls:      ABS,SPEEDAUX,FQUOTIENT
  called by:  SPEED,SPEEDFROM,SWR

STAMMER[]
  calls:      MAPC,WELCOME,EXLOOP,APPLYRULE,PARTING
  uses free:  PRODUCTIONS

STARTUP[]
  calls:      RETRIEVES,INCLUDEPLAT,MAPC,STUFFLN
  called by:  CKCONFIGURATION

STATE[L]
  calls:      CASSERT

STRIPSTREAM[S]
  called by:  GETATT,GETATTB,GETSTRIP,RETRIEVES,UNLESSHACK

STUFFLN[MLN]
  calls:      DSPADDTRH,MAPC,GETATT,DSPADDINC
  called by:  STARTUP
  binds:      VER

SUBTEND[LAT1,LON1,LAT2,LON2]
  calls:      EQP,ABS,FDIFFERENCE,COS,FPLUS,ARCCOS,FQUOTIENT,FTIMES,FMINUS
  called by:  DIRECTION,DISTANCE,LANERANGE
  binds:      C1,C2,C3
```

```
SUCCESSOR[SITE]
  calls:      LESSP,MAPC,GETATTB,GETATT,RETRIEVES
  called by:  COURSE,SPEED
  binds:      PLAT,TOSSITE,TOSX,SUCC,TOSSUC,X

SWEEPER[CONDITIONS,ACTIONS,EV]
  calls:      MEMB,SWEEPER,ORHACK,NOTHACK,UNLESSHACK,ANDHACK,CONSTRUCT,
              GETMRVAL,APPLY
  called by:  SWEEPER,APPLYRULE,ORHACK,ANDHACK,NOTHACK,UNLESSHACK
  binds:      THISCOND,C
  uses free:  VDRELS

SWR[LT1,T1,LT2,T2]
  calls:      CENTROID,LESSP,SPEEDM,DISTANCE
  binds:      L1,L2
  uses free:  MAXSHIPSPEED

TEKCOM[STR]
  calls:      PRIN1,TERPRI
  called by:  GRATEK,MONTEK
  uses free:  TEKCOMCHAR

TEKTEST[]
  calls:      CLEARBUF,PRINCHAR,TERPRI,DISMISS,PRIN1,READP,ASKUSER,READ
  called by:  CKCONFIGURATION
  binds:      UTEKFLG
  uses free:  TEKCOMCHAR,TEK4025,TEKFLG

TEKWAIT[]
  calls:      JSYS
  called by:  WAITER,DSPERASE
  uses free:  DSPTTYCODE,TEKFLG

TRACKINPOLY[TRACK,POLY]
  calls:      SOMELINESEG,FUNCTION,LINPOLY
  binds:      TRACKPT1,TRACKPT2

TWO-PLACE[X]
  calls:      FQUOTIENT,FIX,FPLUS,FTIMES
  called by:  MIDP,MODIFIER

UNCRUNCH[NUM]
  calls:      RPTQ,RPLACA,SETN,LRSH,LLSH
  called by:  DSPNUMAT
  binds:      PTR,RPTN
  uses free:  SCRATCHFIVE
```

```
UNFREEZE[]
  calls:      MAPC,DREVERSE,APPLY*
  called by:  MSGMTR
  binds:      XSUSP
  uses free:  FREEZELST,FREEZEFLG

UNLESSHACK[CONDITIONS,ACTIONS,EV]
  calls:      ORACLEHACK,CASSERT,STRIPSTREAM,RETSTREAM,MASSAGE1,MAPRETRIEVE,
              FUNCTION,LEQ,GETCON,SWEEPER,CONS,LIST
  called by:  SWEEPER
  binds:      P,X,CLIST

VAR?[Q]
  calls:      CHCON1
  called by:  MASSAGE1,ORACLEHACK,PREPALIST,RETSTREAM,RETVARS,RETRIEVER

WAITER[]
  calls:      TERPRI,TEKWAIT,ASKUSER
  called by:  DESCRIBEMSG,PRINTRULEASSR
  uses free:  DUALFLG

WEATHERMSG[TXT]
  calls:      CASSERT,DSPADDTRH,MAPC,LIST,DSPADDINC,FLOAT
  called by:  MSGMTR
  binds:      SNAME,LOC,STVER,TM
  uses free:  DSPLAYFLG

WELCOME[]
  calls:      PRIN1,TERPRI,MAPC,CKCONFIGURATION,LINEREAD,PUTPROP
  called by:  STAMMER
  binds:      NEWFL,TB
  uses free:  ASSERTIONS,MSGFILE

WENT-AFTER[S1,T1,S2,T2,S3,T3,S4,T4]
  calls:      GREATERP,LESSP,CENTROID,DIRECTION,QUOTIENT,TIMES,COS,SIN,
              DIFFERENCE,LIST,PLUS,ARCTAN,ABS,DISTANCE
  binds:      PHI,VM1,VM2,VP1,VP2,P0,P4,PSI,THETA,INITDIST,ENDDIST,MINDIST,
              MINTIME,L1,L2,L3,L4
  uses free:  PATROLRANGE,MAXSHIPSPEED

WENT-BEFORE[S1,T1,S2,T2,S3,T3,S4,T4]
  calls:      LESSP,GREATERP,CENTROID,DIRECTION,QUOTIENT,TIMES,COS,SIN,
              DIFFERENCE,LIST,PLUS,ARCTAN,ABS,DISTANCE
  binds:      PHI,VM1,VM2,VP1,VP2,P0,P4,PSI,THETA,INITDIST,FINDIST,MINDIST,
              MINTIME,L1,L2,L3,L4
  uses free:  PATROLRANGE,MAXSHIPSPEED
```

```
WHAT2FORMFN[PL]
  calls:      APPEND,RETRIEVER,LIST

WHATFORMFN[REL,OBJ]
  calls:      RETRIEVER,LIST,MAPCAR,CDADR
  binds:      ANS
  uses free:  WHATRES,WHATRES2

WHOSE2FORMFN[VAL,REL]
  calls:      RETRIEVER,LIST,MAPCAR,CDADR
  binds:      ANS
  uses free:  WHOSE2RES,WHOSE2RES2

WITHINR[L]
  calls:      NCONC,MAKEFILE
  uses free:  WITHINRFNS

YESNO[ASSRSPEC]
  calls:      EQP,TERPRI,PRIN1,GAMF,GETSTRIP,GETCON
  binds:      NDECON,NDE
```

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